DOCUMENT RESUME

ED 480 397 CE 085 406

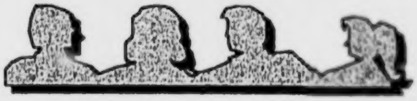
AUTHOR	Sticht, Tom
TITLE	Functional Context Education: Making Learning Relevant.
PUB DATE	2000-00-00
NOTE	116p.; For full text of an earlier (1997) version: http://www.nald.ca/fulltext/context/context.pdf.
PUB TYPE	Information Analyses (070)
EDRS PRICE	EDRS Price MF01/PC05 Plus Postage.
DESCRIPTORS	Adult Basic Education; *Adult Literacy; Basic Skills; Case Studies; Cognitive Development; *Cognitive Processes; Cognitive Psychology; Constructivism (Learning); *Context Effect; Cooperative Learning; *Curriculum Development; Diversity (Institutional); Educational Research; Functional Literacy; *Literacy Education; Problem Solving; *Program Development; Relevance (Education); Student Diversity; Workplace Literacy
IDENTIFIERS	Cognitive Sciences; Functional Context; *Functional Context Education; Situated Learning

ABSTRACT

This notebook discusses issues and methods of developing adult literacy education (ALE) programs according to functional context education (FCE) principles. Chapters 1-3 in Part 1, The Power of ALE, focus on current ALE; address why ALE is of growing importance; show how investments can return benefits for adults and others; look at issues involved in trying to find out how many adults are at risk because of their literacy skills; review the National Adult Literacy Survey; discuss problems in determining how much is enough literacy; describe diversity among adult literacy students and adult education settings and how it can affect program development; summarize data on learning gains in ALE programs; and show that the results suggest a need for more attention to development of ALE programs based on results of cognitive science and principles of FCE. Chapters 4-6 in Part 2, Cognitive Science Foundations, provide a summary of contemporary cognitive science as it relates to FCE and show how concepts of FCE relate to other advances in educational research; and discuss concepts such as the social basis of cognition and literacy, constructivism, situated cognition and practice, contextual learning, anchored instruction, problem-based learning, cooperative learning, multiliteracies, and multiple modes of representation in relation to FCE. Chapters 7-10 in Part 3, Case Studies in FCE, provide four case studies of ALE programs that illustrate how to apply the principles of FCE to curriculum development and assessment. (YLB)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 480 397



Functional Context Education

Making Learning Relevant

Tom Sticht
International Consultant in Adult Education

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

T. Sticht

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

BEST COPY AVAILABLE

© Thomas G. Sticht, 2000

Functional Context Education

Table of Contents

Introduction 1

Part 1 *The Power of Adult Literacy Education* 9

Chapter 1 The Growing Value of Adult Literacy Education in the New Millennium 11

Chapter 2 The Literacy Skills of Adults: Assessments and Issues 19

Chapter 3 Some Challenges of Diversity For Adult Literacy Education 27

Part 2 *Cognitive Science Foundations For Adult Literacy Education* 39

Chapter 4 Views On Contemporary Cognitive Science 41

Chapter 5 Introduction to Functional Context Education 51

Chapter 6 Functional Context Education and Literacy Instruction 63

Part 3 *Case Studies in Functional Context Education* 75

Chapter 7 Functional Context Education Case Study #1: The Functional Literacy (FLIT) Program 77

Chapter 8 Functional Context Education Case Study #2: A Pre-employment, Job-Related Basic Skills Program 89

Chapter 9 Functional Context Education Case Study #3: An Integrated Basic Skills and Electronics Technician's Course 99

Chapter 10 Functional Context Education Case Study #4: An Intergenerational Literacy Parenting Program 109

Introduction

In 1987, Arnold Packer, then of the Hudson Institute, visited me at the Applied Behavioral & Cognitive Sciences, Inc. (the ABC'S) in San Diego. At that time I briefed him on the work we had been doing on Functional Context Education (FCE) and gave him some materials about FCE. Later that year Packer sent a letter to me at the ABC'S saying that, "I have just finished reading your "Functional Context Learning." It makes a great deal of sense to me and fits all my prejudices."

Three years later, on February 20, 1990, then Secretary of Labor Elizabeth Dole formed the Secretary's Commission on Achieving Necessary Skills -SCANS. The Mission for SCANS was to "define the necessary functional and enabling skills which society must provide to every child by the age of sixteen."

Arnold Packer was asked to serve as Executive Director of the SCANS and I was invited to be one of the SCANS commissioners. At the first meeting of the SCANS I made a presentation about Functional Context Education and its application to preparing youth and adults with the basic skills needed for work. After that, the SCANS staff conducted studies of the cognitive science research literature related to the importance of learning in context, and a meeting was held with a number of cognitive scientists to determine the usefulness of FCE concepts. Based on that research, the Mission Statement for SCANS was drafted and stated that "We believe that these skills are best learned in context and especially in the context of realistic workplace problems. Thus the teaching of functional skills will require the most radical change in educational content since the beginning of this century."[1]

What is Functional Context Education (FCE)?

Functional Context Education is an approach to education that is based upon a cognitive science theory of cognitive development, learning, and instruction. The theoretical framework and the principles for applying this framework to the task of instructional development are discussed in this notebook.

Literacy is given special attention in FCE because of its importance to all schooling and instruction in our information age. A general thesis is that the idea that literacy is something one must "get" in one program, which is then "applied" in another is misleading. Rather, it is argued that literacy is developed while it is being applied. This means that for the large numbers of youth and adults who read between the fifth and ninth grade levels, literacy and content skills education can be integrated. Therefore there is no need for special "remedial" literacy programs to get students to "prerequisite" levels of literacy before they are permitted to study the "real thing."

In overview, education based on functional context theory includes the following conceptual framework:

- *Society and culture* provide the most important resources for human cognitive development. These resources include symbols and symbol systems, such as the natural language and conceptual (in contrast to perceptual) knowledge, which constitute the primary means for the transmission of cognitive abilities.

- *The learner possesses a "human cognitive system"* with an internal knowledge base "inside the head" and access to an external knowledge base in the world "outside the head." The learner has a working, or short term memory in which processing skills such as language are used to move information in and out of both the internal and external knowledge bases.

- *Learning is information processing* whereby the learner actively seeks out information used in constructing a meaningful interpretation of the world and a knowledge base comprised of these interpretations.

- *A developmental perspective of literacy* emphasizing the development of oral language from earlier prelinguistic knowledge and literacy as the amalgam of prelinguistic, linguistic and graphic symbolic knowledge.

- *The importance of context* in learning new information and in transferring information already learned to new and different problems and situations.

The application of this theoretical framework to the instructional development process suggests creating courses that facilitate learning on entry into the course, learning throughout the course, and transfer into the contexts for which the learning is meant to apply. To accomplish these objectives, courses should be developed that:

- Explain what the students are to learn and why in such a way that they can always understand both the immediate and long term usefulness of the course content (facilitates entry into the course; motivates learning).

- Consider the old knowledge that students bring with them to the course, and build new knowledge on the basis of this old knowledge (facilitates entry learning)

- Sequence each new lesson so that it builds on prior knowledge gained in the previous lessons (facilitates in-course learning).

- Integrate instruction in reading, writing, arithmetic, and problem solving into academic or technical training programs as the content of the course poses requirements for information processing using these skills that many potential students may not possess; avoid decontextualized basic skills "remedial" programs (facilitates in-course learning; motivates basic skills learning; reduces instruction time; develops "learning to learn" ability).

- Derive objectives from careful analysis of the explicit and tacit knowledge and skill needed in the home, community,academic, technical training, or employment context for which the learner is preparing (facilitates transfer).

- Use, to the extent possible, learning contexts, tasks, materials, and procedures taken from the future situation in which the learner will be functioning (facilitates transfer).

Why is FCE important for youth and adult education?

Unlike children, who tend to do things to please their parents or teachers, youth and adults will usually want to understand the functional utility of investing time and mental energy in learning something. With respect to out-of-school youth and adults then, FCE focuses on improving

(1) *Participation* in adult education programs by making explicit the relationship between what students want to learn, what is being taught and its application in the contexts that the person will be functioning in after the educational program, this promotes increased motivation;

(2) *Achievement* in learning and transfer by ensuring that instruction relates to the learner's prior knowledge in such a way that the learner can function within the learning situation and improving transfer by deriving instructional contents as much as possible from the future contexts in which the person will apply the learning, and

(3) *Prevention* of learning problems in future generations by designing youth and adult programs that maximize the intergenerational transfer of the adults' new skills and attitudes about education to their children.

Functional Context Education: Historical Background

The codification of the principles and concepts for the contextualiztion of instruction that make up *Functional Context Education* occured a decade ago, in 1987. That year a team of educators, instructional technologists and cognitive scientists published the results of a four year research and development project in a book entitled *Cast-off Youth: Policy and Training Methods From the Military Experience.*[2] The book reported the results of Ford Foundation-funded research that reviewed some 50 years of R & D in the military to develop technical training programs and literacy programs to accommodate adults reading from zero to fifth grade levels. It noted that Harry Shoemaker of the Human Resources Research Organization (HumRRO), who later became Training Manager for AT&T, coined the phrase, "Functional Context Method" in 1960 to describe new, more effective methods for teaching vocational skills that were developed in the military.

In 1987, the Ford Foundation funded a series of workshops to disseminate ideas from *Cast-off Youth*. For dissemination purposes, the phrase "functional context method" was changed to "functional context education" to show its broadened use beyond vocational training to include adult literacy education. Two full day workshops were held in Pensacola, Florida, two in Pennsylvania at Temple University and the Pennsylvania State University, two in Boston at the Harvard Graduate School of Education, one at New York University in New York City, two in Washington, DC, and one in Mineappolis, Minnesota.

Today FCE has been reviewed and recommended as a viable approach to teaching academic, vocational, parenting and basic skills by the American Society for Training and Development, the National Workplace Literacy Program, the Work In America Institute, Wider Opportunities for Women, the Secretary's Commission on Achieving Necessary Skills (SCANS) and others.[3]

How FCE Differs From Traditional Adult Literacy Education

The Functional Context Education (FCE) approach to workforce literacy development differs in three significant ways from other approaches to adult literacy instruction. First, it evolved from research and development in work contexts with adults. The FCE methods were developed over nearly a half century of R & D by the U. S. military.[2]

Second, the FCE concepts about adult literacy that were developed during the War on Poverty were based on a blend of the instructional technology practices that came out of the field of the behavioral science of the time, featuring individualized, self-paced, competency-based education, and human information processing concepts from the field of cognitive psychology as it emerged during the 1950's, '60's and '70's. Thus, FCE was based on behavioral and cognitive psychology rather than traditional adult education philosophy and practice. The behavioral and cognitive science concepts made it possible to build on the military's earlier functional literacy training developed during World War II and design literacy programs that were characterized by a strong job-related focus to improve transfer of learning from the literacy programs to job training, and the use of multiple modes of representation of information to improve the learning of vocabulary and job concepts during the literacy program.

Third, and most important, using standardized testing procedures FCE applied to adult literacy instruction was repeatedly and empirically demonstrated to be more effective than the existing programs developed by adult educators in improving the job literacy skills of personnel, and equally as effective in improving the general literacy skills of personnel.

Origins of Functional Context Education

Starting in World War II, the military services conducted extensive programs that aimed at providing new recruits with reading skills of a functional nature. Soldiers and sailors learned to read so that they could comprehend material about military life. Because the time for teaching literacy was very limited, less than three months usually, the reading instructional materials had the structural complexity of materials typically encountered by the end of the fourth grade of public education, but they did not cover the breadth of content that a typical fourth grader would have encountered. Rather, they taught reading by emphasizing a relatively narrow body of knowledge about the military. Further, the readers were designed to build on the new recruit's experiences and prior knowledge about the world acquired before entering service. For instance, the Private Pete series starts with Pete at home on the farm. Then he goes to a recruiter and signs up to join the Army. Then he rides a train to camp and is assigned to a barracks, etc. Because that is the procedure that the vast majority of new recruits in literacy programs followed in joining the Army in the 1940's, this was content (prior knowledge) that they could talk about and comprehend, but they could not necessarily read words in the written language like "farm," "recruiter," "train," "barracks," etc.

Given the severe time limits, the military programs were designed so that the recruits would only have to learn what they did not know. So if a soldier already had some basic decoding skills and could already recognize some words in print, emphasis was on providing practice in reading to develop word recognition skills to higher levels, and to develop new vocabulary and concepts about military life.

Those with greater needs for word recognition training were taught phonics, linguistic and whole word methods of sounding-out and recognizing words in the written language that they could already understand in the spoken language. This way, there were not two things to be learned at once: decoding skills and new knowledge (new vocabulary and concepts about military life). Word recognition was done with "old" knowledge during reading instruction, and at other times, through discussions and "hands-on" training "new" knowledge was taught.

The War on Poverty Era

During the Vietnam war, the U. S. Army recruited more highly literate personnel, but they also required higher levels of literacy due to the increased technological complexity of the military environment.[4] They developed literacy programs that continued the practice of focusing on a narrow body of functional content, but this time the literacy programs used materials not about general military life, but about specific job content. In this case, recruits about to become cooks learned word recognition and comprehension skills by reading from cook's materials. Those who were going to be automobile mechanics read mechanic's materials, those becoming medics read medic's materials, etc.

Because most of the new recruits in the military's literacy programs of the late 1960's and the 1970's were not at the very beginning levels of reading, most had skills at the 4th to 6th grade levels, emphasis was on reading for comprehension and thinking. For instance, men read passages about first aid procedures, and were taught to draw pictures about what they read to bring their prior knowledge to bear on providing a context for the first aid knowledge. They also learned to flow chart their first aid procedures to develop analytical, procedural thinking skills and to acquire the new content at a "deeper" level. They learned to make classification tables from passages of connected prose so that they could better compare and contrast various types of materials, equipment, or methods, such as different communications techniques (e.g., hand and arm signals, messengers, telephones, radios).

In extensive research, the new, job-related, functional literacy programs of the Vietnam era were compared to general literacy programs that the Army already had in place. Studies showed that general literacy programs made very little improvements in soldier's abilities to read and comprehend their job-related materials in the six weeks of full time study that the Army would permit for literacy training. But in the same amount of time, the job-related literacy programs made about as much improvement in general literacy as the general literacy programs made, but four to five times the amount of improvement in job-related reading that the general literacy programs made[2] Importantly, the troops in the job-related programs felt they were getting job training, not "remedial" training with all the stigma attached to that concept.

Further R & D during the 1970's and 1980's demonstrated the functional context approach to basic skills and occupational knowledge instruction and extended the methods to the use of computer-based technologies.[5]

Implications for Adult Literacy Instruction

The military work obviously has implications for adult literacy instruction in civilian contexts. First, most adults do not want to attend "remedial" literacy programs any more than military personnel wanted to. Adults generally want literacy improvements to pursue some other goal, such as getting into a job or into job training. Certainly, this is true for the millions of adults who wish to get off of welfare and into a good, well-paying job.

The military research and experience indicates that reading can be taught in the functional context of job training (or other contexts, such as parenting, religious study, etc.) right from the beginning levels of learning to read. By embedding literacy learning within the context of job training, adults will more rapidly progress from literacy to job training to work. But to become broadly literate, adults will have to engage in wide-ranging reading for some years. Military research indicated that it may take the normal, typical child six to eight years to become as competent in reading and comprehending the written language as he or she is at listening to and comprehending oral language.[6,7] It takes the typical reader with high school skills 12 years of reading broadly across a number of content areas (science, literature, history, etc.) to become a 12th grade level reader. So becoming highly and broadly literate when one starts from a low baseline of both knowledge (vocabulary, concepts) and word recognition takes a long time.

Typically, however, adults do not have a long time to learn literacy so they can improve their work opportunities, parenting needs, and so forth. For this reason, the functional context approach combines basic skills education with functional content learning. This offers the fastest way to get adults from basic literacy to well-paying jobs and more informed parenting. Then, a program of lifelong learning, including continuous, well-rounded reading can be pursued to become literate enough to qualify for higher education or advanced job training to move into better paying careers or to simply enjoy the many personal, social, and cultural benefits of higher knowledge and disciplined thinking skills.

This notebook provides an overview of issues and methods involved in the development of adult literacy education programs according to functional context education principles. There are three parts to the notebook.

Part 1: The Power Of Adult Literacy Education, includes three chapters that focus on the present state of affairs in adult literacy education in the United States.

Chapter 1 provides an overview of just why adult literacy education is of growing importance in the coming millenium. It shows how investments in adult literacy education can return benefits not only for adults but also for employers, community participation, and adult's children.

Chapter 2 looks at the issues involved in trying to find out how many adults are "at risk" because of their literacy skills. It reviews the recent National Adult Literacy Survey (NALS) and discusses problems in determining "how much is enough" literacy.

Chapter 3 presents an overview of the great diversity in the United States among adult literacy students and adult education settings, such as jails, community colleges, etc. and how this diversity can affect the development of programs of instruction for adults. It also summarizes data on gains in learning in a variety of adult literacy programs and the results of recent evaluations of adult literacy education programs in the United States. It shows how these results suggest the need for more attention to the development of adult literacy education programs based on the results of cognitive science and the principles of functional context education.

Part 2: Cognitive Science Foundations, includes Chapters 4, 5, and 6. These chapters provide a summary of contemporary cognitive science as it relates to functional context education. They show how the concepts of functional context education relate to other advances in educational research over the last decade. Concepts such as the social basis of cognition and literacy, constructivism, situated cognition, situated practice, contexual learning, anchored instruction, problem-based learning, cooperative learning, multiliteracies, and multiple modes of representation are among the many ideas that are discussed in relation to functional context education in these chapters.

Part 3: Case Studies in Functional Context Education, includes Chapters 7,8,9, and 10. These chapters provide four case studies of adult literacy education programs that illustrate how the principles of functional context education can be applied to curriculum development and assessment.

References

[1] Secretary's Commission on the Achievement of Necessary Skills (SCANS). (1991, June). *What Work Requires of Schools: A SCANS Report for AMERICA 2000*. Washington, DC: U. S. Department of Labor.

[2] Sticht, T. G., Armstrong, W. B., Hickey, D. T., & Caylor, J. S. (1987). *Cast-off Youth: Policy and Training Methods from the Military Experience*. New York: Praeger.

[3] Sticht, T. G. *Functional Context Education: Professional Development for Workforce Education & Lifelong Learning Specialists (WELLS)*. El Cajon, CA; Applied Behavioral & Cognitive Sciences, Inc.

[4] Sticht, T. G. (1975). *Reading for Working: A Functional Literacy Anthology*. Alexandria, VA: Human Resources Research Organization.

[5] Sticht, T. G. (1992, October). *The Military Experience and Workplace Literacy: A Review and Synthesis for Policy and Practice*. Pennsylvania, PA: National Center on Adult Literacy, University of Pennsylvania.

[6] Sticht, T. G., Beck, L. J., Hauke, R. N., Kleiman, G. M., & James, J. H. (1974). *Auding and Reading: A Developmental Model*. Alexandria, VA: Human Resources Research Organization.

[7] Sticht, T. G. & Armstrong, W. B. (1994, February). *Adult Literacy in the United States: A Compendium of Quantitative Data and Interpretive Comments*. Washington, DC: National Institute for Literacy.

What do Others Say about Functional Context Education?

"The popularity of "functional context literacy training," which presents literacy training in the context of skills required on the job, and the emerging convention that students learn best when competencies are taught in some concrete application (or contextualized) suggest that coordinating remediation with job skills training might be effective.(p.iv). ...functional context training seeks to "integrate literacy training into technical training" on the grounds that learning basic skills is easier in the context of vocational training where such skills have obvious applications."---W. Norton Grubb, et al (1991, September). Readin', writin', and 'rithmetic one more time: The role of remediation in vocational education and job training programs. Report to Congress, the Secretary of Education, and the Secretary of Labor. Berkeley, CA: National Center for Research in Vocational Education.

"Although there is some argument about the differences between education and training, the functional-context approach transcends such differences and operates from similar assumptions about how the human mind operates. ..."The functional context principle states that skills and knowledge are best learned if they are presented in a context that is meaningful to the person."---Anthony Carnevale, Leila Gainer & Ann Meltzer (1990). Workplace Basics: The Essential Skills Employers Want. San Francisco: Jossey-Bass, pp. 415-416.

"The workplace literacy movement evolved directly from ... analysis of literacy demands in the military which found that using job-specific materials improved job performance more than using general academic materials....In a functional context-oriented program, instructional materials are drawn from actual work materials."---Mark Kutner, Renee Sherman & Lenore Webb (1991, May). A Review of the National Workplace Literacy Program. Report prepared for the U.S. Department of Education, Office of Planning, Budget & Evaluation. Washington, DC: Pelavin Associates, pp. 14,22.

"In recent years it has come to be widely accepted that the form of workplace basic skills training that most effectively motivates employees to seek and complete training and apply it successfully to the job is the functional context (FC) method....In the workplace, some of the strongest motivations among applicants and employees are to get or to hold a job or to gain a better one. These goals, then, which coincide with the employer's, provide the most reliable functional context for basic skills training in the workplace, and the training methods and contents are specifically organized to achieve them."---Jerome Rosow & Robert Zager (1991). Job-Linked Literacy: Innovative Strategies at Work. Scarsdale, NY: Work in America Institute, pp. 8,9.

"Individuals learn best when they are taught in a context of application--*in a functional context*....Cognitive science strongly implies that people learn knowledge and skills best when they are taught in the context of real situations, real activities, and real problems "---Michael Kane, Sue Berryman, David Goslin, & Ann Meltzer (September 17, 1990). How to Identify and Describe Necessary Skills Required by Work. Report prepared for the Secretary's Commission on Achieving Necessary Skills, U. S. Department of Labor. Washington, D.C.: Pelavin Associates, pp. 1,7.

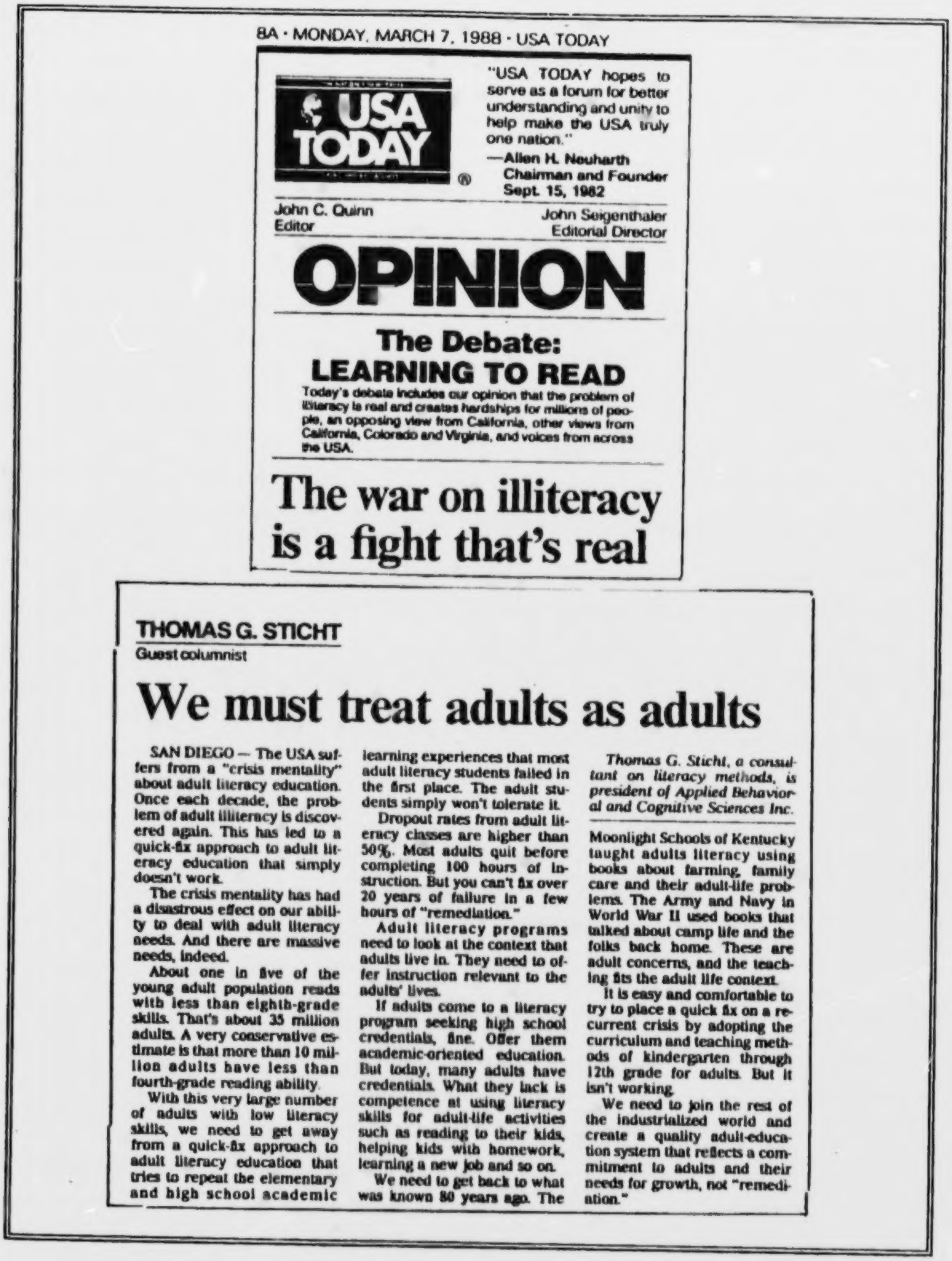
"...literacy skills can be learned far more rapidly when they are taught as part of the processes of teaching job skills....A side benefit of functional context instruction is that there is no stigma attached to learning job skills as there can be in learning "literacy" skills. Thus the dignity of the adult learner is safeguarded."---Ray Uhalde, Deputy Administrator, Office of Strategic Planning and Policy Development, Employment and Training Administration, U.S. Department of Labor, Washington, D.C. In: Literacy and the Marketplace. New York: The Rockefeller Foundation, June 1989,pp. 37-38.

"The basic skills requirements of ...jobs should ...be determined and the curriculum built on that basis, using artifacts and simulations of actual tasks to be performed. These activities are best articulated in the functional context approach...work in the military indicated that "we can improve the capability of people by teaching basic skills embedded in job materials. Basic skills can be learned while you apply them."---Benita Somerfield, Executive Director, The Barbara Bush Foundation for Family Literacy; (formerly) Special Advisor, Division of Adult Education, U.S. Department of Education, Washington, D.C. In: Literacy and the Marketplace. New York: The Rockefeller Foundation, June 1989,p. 61.

BEST COPY AVAILABLE

Part 1

The Power of Adult Literacy Education



8A · MONDAY, MARCH 7, 1988 · USA TODAY

USA TODAY

"USA TODAY hopes to serve as a forum for better understanding and unity to help make the USA truly one nation."
—Allen H. Neuharth
Chairman and Founder
Sept. 15, 1982

John C. Quinn
Editor

John Seigenthaler
Editorial Director

OPINION

The Debate: LEARNING TO READ

Today's debate includes our opinion that the problem of illiteracy is real and creates hardships for millions of people, an opposing view from California, other views from California, Colorado and Virginia, and voices from across the USA.

The war on illiteracy is a fight that's real

THOMAS G. STICHT
Guest columnist

We must treat adults as adults

SAN DIEGO — The USA suffers from a "crisis mentality" about adult literacy education. Once each decade, the problem of adult illiteracy is discovered again. This has led to a quick-fix approach to adult literacy education that simply doesn't work.

The crisis mentality has had a disastrous effect on our ability to deal with adult literacy needs. And there are massive needs, indeed.

About one in five of the young adult population reads with less than eighth-grade skills. That's about 35 million adults. A very conservative estimate is that more than 10 million adults have less than fourth-grade reading ability.

With this very large number of adults with low literacy skills, we need to get away from a quick-fix approach to adult literacy education that tries to repeat the elementary and high school academic learning experiences that most adult literacy students failed in the first place. The adult students simply won't tolerate it.

Dropout rates from adult literacy classes are higher than 50%. Most adults quit before completing 100 hours of instruction. But you can't fix over 20 years of failure in a few hours of "remediation."

Adult literacy programs need to look at the context that adults live in. They need to offer instruction relevant to the adults' lives.

If adults come to a literacy program seeking high school credentials, fine. Offer them academic-oriented education. But today, many adults have credentials. What they lack is competence at using literacy skills for adult-life activities such as reading to their kids, helping kids with homework, learning a new job and so on.

We need to get back to what was known 80 years ago. The Moonlight Schools of Kentucky taught adults literacy using books about farming, family care and their adult-life problems. The Army and Navy in World War II used books that talked about camp life and the folks back home. These are adult concerns, and the teaching fits the adult life context.

It is easy and comfortable to try to place a quick fix on a recurrent crisis by adopting the curriculum and teaching methods of kindergarten through 12th grade for adults. But it isn't working.

We need to join the rest of the industrialized world and create a quality adult-education system that reflects a commitment to adults and their needs for growth, not "remediation."

Thomas G. Sticht, a consultant on literacy methods, is president of Applied Behavioral and Cognitive Sciences Inc.

BEST COPY AVAILABLE

Chapter 1

The Growing Value of Adult Literacy Education in the New Millenium

The Organisation for Economic Co-operation and Development (OECD) reported in 1992 that in many industrialized nations, the formal educational system for children is not as effective as it should be in producing adults with the literacy skills needed to meet the demands of contemporary society, particularly the world of work. Many of the young adults entering the workforce are considered lacking in basic reading, writing, and mathematics skills. According to the OECD, "functional illiteracy" is a growing problem in the workforces of many industrialized nations.[1] (p. 10)

The OECD report noted that in Canada, 38 percent of adults were considered so lacking in literacy skills that they could not meet most everyday reading demands (p. 25). Officials from Germany estimated that there were between 500,000 and 3 million illiterates in Germany .(p. 40) In France, illiteracy was said to affect some 1.4 million immigrants and 1.9 million French-born persons 18 years and older. (p.28)

Newspaper articles in both the United States and England have reported in the last years large numbers of adults to be seriously lacking in literacy skills. In London, the *Daily Mail* of September 30, 1992 published an article stating that "Eight million Britons are so illiterate they are unable to follow up a job advert." The following year, the Los Angeles Times of September 29, 1993 reported that "...80 million Americans are deficient in the basic reading and mathematical skills needed to perform rudimentary tasks in today's society."

In addition to the general literacy problems identified by these various studies and newspaper reports, problems of specific workplace literacy were also reported by the OECD. Here, the OECD considered that the problem was not one of failing to meet literacy standards upon entrance into the workforce, but rather one in which the literacy demands of jobs in particular workplaces had changed. In this case, previously qualified workers faced new literacy demands for which they were no longer qualified.[1](p. 13)

Better Educated Adults are More Productive for Society

While acknowledging the paucity of trustworthy data, the OECD estimated that about one-third of workers could do their jobs better if they were more literate. In one survey, about one-third of Canadian firms reported serious difficulties in introducing new technology and increasing productivity because of the poor skills of their workers. In Britain, a survey suggested that "Britain's general 'under-education' would create serious economic problems when competition with more highly-skilled nations intensified in the single European market" (The Daily Telegraph, September 30, 1992). Studies in the U. S. indicated that more highly literate personnel who use their literacy skills while performing job tasks such as automobile repair or supply clerks' jobs, may show productivity increases of as much as ten to fifteen percent.[2](pp. 17-18)

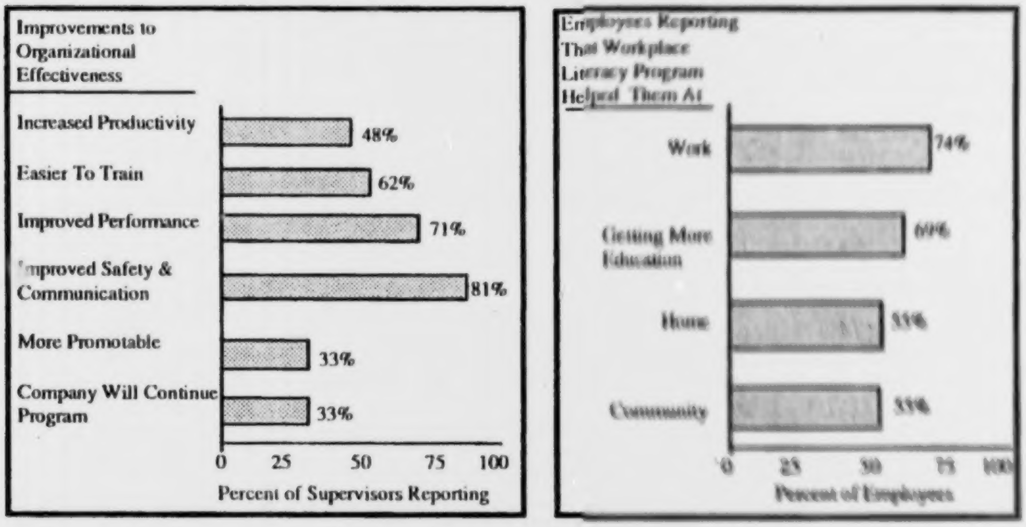
Workplace Literacy Programs Can Increase Productivity Not Only at Work, But Also at Home and in the Community and Schools

In recent years, due primarily to the now defunct National Workplace Literacy Program (NWLP) in th United States, a body of research has emerged on workplace literacy programs in which functional context methods have been used to teach English, reading and mathematics skills integrated with job knowledge. The general results of this body of research is that such programs may contribute not only to improving adult's job-related literacy and numeracy skills, but also to improved productivity on the job[15], increased reading to children at home, thereby better preparing them for and helping them in school, increased use of language and literacy skills in the community, and the decision to pursue further education.

In one study, ten manufacturing companies in the area of Chicago, USA, making products ranging from hydraulic valves to bubble gum, provided basic English language, reading and mathematics education for over 700 employees. In evaluation studies conducted in six of the companies, many supervisors reported that the programs had a variety of positive effects on organizational effectiveness, including increased productivity, employees became easier to train, their job performance, safety, and communication improved, many became more promotable, and a third of them said their companies would continue the programs.[3] (pp. 6-9)

The majority of the employees themselves said that the workplace literacy programs had helped them not only at work, but also at home and in the community, and most were encouraged to seek further education (Figure 1.1).

Figure 1.1 Effects of Workplace Literacy Programs in the Chicago Area, 1994



As these and other studies show, an investment in functional context education at work may provide "double duty dollars," returning benefits not only on the job, but also at home, in the community and at school. Importantly, these benefits to organizational, individual, family and K-12 school effectiveness occur directly following adult literacy programs and serve to make the current workforce more productive. *To accomplish the improvement of the workforce through the formal school system with children would mean that, not only would many schools have to become much more effective than they are today, it would take several generations to replace the present workforce. The economic return to investment in adult education is immediate.*

BEST COPY AVAILABLE

Better Educated Adults Produce Safer Communities Conducive to Learning

In a five year program of research, Shirley Brice Heath and associates studied a wide variety of different community organizations serving inner-city youth in the United States.[4](p.5) They found that over 90 percent of the organizations were described by local city officials as serving "communities suffering from poverty, crime, severe ethnic tensions, teenage pregnancies, and broken homes."

In San Diego, California, USA, a study of the community being served by four adult continuing education centers confirmed many of the findings of Brice Heath and associates.[5] (p. 16) Compared to the total San Diego area, in the inner-city community there was more crime, teenage pregnancy, high infant mortality, unemployment, and poverty. Importantly, more than one in five of the adults 25 years of age or older in the inner-city community had fewer than nine years of education, while in the surrounding communities less than one in 17 of the adults had fewer than nine years of education.

Communities of better educated adults who are workers, citizens, and parents may attract better paying jobs into the community which provide a higher tax base that will support better social services (law enforcement, day care, recreational facilities, transportation, etc.), and promote a safer, supportive community that can produce drug and violence free schools and influence better teaching and greater success for children in school .

In one workplace education project in the U.S., management, labor union members, and educators got together at AC Rochester in upstate New York, a supplier of components for General Motors automobile manufacturing, and developed adult education programs in basic education, English as a second language, secondary school completion and basic reading skills programs. This was done because it was discovered that many employees could not benefit from training that was needed to convert the manufacturing plant to a high performance organization in which each worker had to take on more responsibility for quality control, work scheduling and so on. As a consequence of the company's reorganization and education programs, a new billion dollar contract was signed with a foreign nation and General Motors moved new work into the plant.[6](pp. 49-55) This suggests that organizational changes and greater investments in adult education may lead to economic growth in the community and provide a better tax base for community activities and facilities.

Better Educated Adults Demand and Get Better Schooling for Children

Improved education of adults may lead not only to a better tax base and community social services, it may also stimulate a greater interest on the part of parents to become involved with the education of their children. Research by the Wider Opportunities for Women in Washington, DC, USA, studied the effects of women's participation in basic skills training on (1) their behavior toward their children, (2) their interactions with teachers and participation in school activities, and (3) their children's behavior in school.[7]

Mothers reported that, as a result of their participation in the basic skills programs, they spent more time with their children talking about school, helping with homework, and other activities. They spent more time going to and helping with school activities and they talked more with teachers about their children's education. (see figure 1.2, along with comparable data from the National Center for Family Literacy in 1994;[12] all improvements are statistically reliable). WOW mothers also reported that their children liked and attended school more, and they made improvements in their school grades, test scores , and reading.

Figure 1.2 Parent's activities with children before and after education programs.

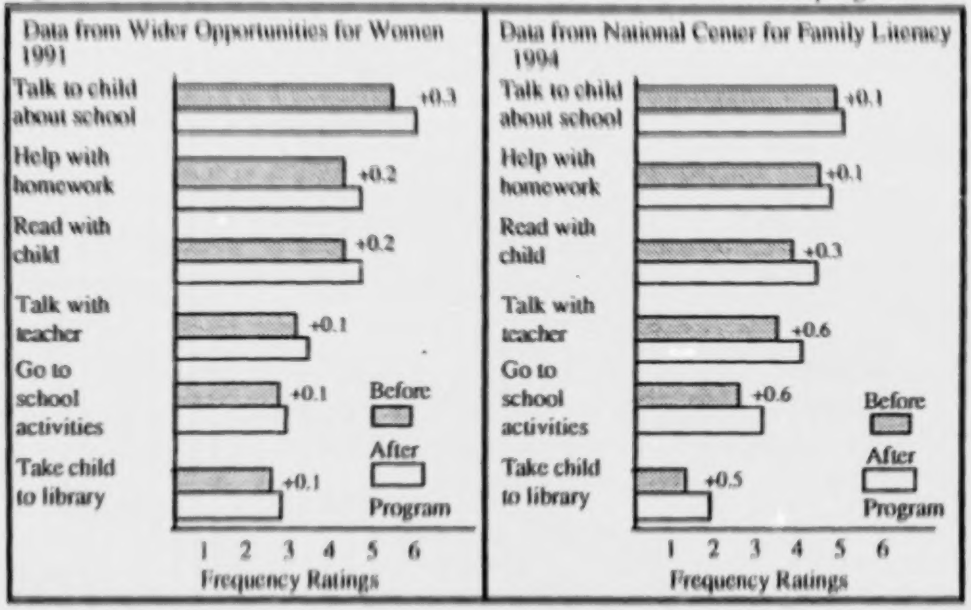


Table 1.1 presents samples of observations by interviewers who went to the mothers' homes to find out if there were indicators beyond the self-reports of the women that participating in the program had some effects on the women's children. As indicated, home observers found that children reported changed attitudes about the value of education, and that their mother's helped them with their homework and read to them more.

Table 1.1 Examples of comments recorded by observers in home visits to mothers involved in the study of the intergenerational transfer of literacy skills by Wider Opportunities for Women (WOW).

Mother and child activity	**Notes from home visits and interviews**
Talk to child about school	"The kids say they had definitely seen a big change in their mother...she is happier and likes learning and studying with them. She "constantly" tells them how important it is to stay in school and get a good education, so they won't live like she had to." (WOW Case C)
Read with child	LD's son was glad his mother was going to school because "...she read him and his sisters stories and showed him words in the books." (MCA Case A)
Help child with homework	"The second-grader said, "I do my homework just like mommy"...and thrust his homework into the interviewer's hand." (NEW Case C)
Talk with child's teacher	"The client states...that now when she meets with the teacher, she is not intimidated and can discuss a workable solution that involves both teacher and parental support." (WOW Case B)
Take child to library	The mother states she "frequently goes to the Goodwill to purchase used books. I saw a nice collection of nursery rhymes, CAREBEARS, and other primary books in the small apartment." (WOW Case B)

BEST COPY AVAILABLE

Better Educated Adults Produce Better Educated Children

Closely related to the foregoing, and perhaps the most significant benefit of adult literacy education is that which undergirds the current interest in family literacy programs. In numerous studies, the variable that has remained most influential in children's participation and success in school is parental education levels. Briefly, what has been discovered is that, as a general trend, the more highly educated the parents, the greater will be the success in providing education to children.

Data from national surveys of literacy in the United States show that parents' education levels are related to the development of reading skills at ages, 9, 13, 17 and adulthood.[8] (pp. 127-131) Similarly, in England, studies of the literacy and numeracy skills of adults indicated that those with low literacy and numeracy scores tended to come from unskilled family backgrounds and to have parents whose own educational attainment had been poor.[9] (p. 63)

By and large, literacy will be found in greatest abundance where there are literates who make wide use of their literacy. It is typical to find that the homes and communities of literates are likely to contain more literacy artifacts, such as signs, books, magazines, pencils, typewriters, writing paper, and so forth, than the homes and communities of non-literates or literates who make only restricted use of their literacy.

Generally speaking, in homes where there are literate parents who use their literacy extensively, infants born into such richly nourishing cultures of literacy tend to grow literate to a large extent even before they enter into a special environment for cultivating literacy (primary school).

In the literate home and community culture, the newborn illiterate gradually acquires literacy, including the knowledge of the *forms* of literacy, such as signs, books, letters, and so forth, and the *functional uses* of literacy. Importantly, the emergent literate also acquires a *value* for literacy that is reinforced by parents and others in the literate culture of the home and community.

Parents' Influences on Schooling. For schools to have an effect, they must have healthy students prepared to learn. A very large body of research in both developed and developing nations suggests that parents', and especially mothers' education level is one of the most important determinants of school participation and achievement.[10,11] Despite this relationship of mothers' education to children's educability, many nations have supported in the past, and many continue into the present to support policies that relegate girls and women to a secondary place in education. It is for these reasons that the United Nations called for greater equality of educational opportunities for girls and women in its declaration of the International Year of the Family.

The failure to focus resources on girls and women shows itself in the international literacy statistics compiled by UNESCO. These statistics indicate that women, that is, female adults over the age of 15, comprised almost two-thirds of the 963 million adult illiterates in the world in 1990. Of the 116 million of the world's children below the age of 11 who were unable to attend primary school in 1985, almost two-thirds were girls.[12] (p. 13)

Table 1.2 summarizes research on the effects of mothers' education on children and their educational development at various developmental stages, begining with the role of education on the initial propensity to have children. Girls' and mothers' education is important in determining fertility rates, that is, just how many children there will be in the household. The latter, in turn, is related to the preschool cognitive development of children and their subsequent achievement in school.

Table 1.2 Some effects of higher levels of mother's education at different phases of child bearing and schooling.

Phase of child bearing/schooling	**Effect of higher levels of mother's education**
Before pregnancy	Higher economic productivity; better personal health care; lower fertility rates; smaller families
During pregnancy and at birth	Better prenatal care; more full term births; higher birthweight babies; fewer learning disabilities
Before going to school	Better health care; better development of language, cognitive, and literacy skills; better preparation for schoolwork
During the school years	Higher participation rates in the schooling process; better management of homework; better advocacy for children's education and negotiation of school/child conflicts; higher academic achievement by children

Given that conception and motherhood have occurred, the next question concerns the pre-and postnatal conditions that permit the birth of healthy children who will survive. Mortality rates and the health of young, preschool children determine how many children will be available to benefit from primary education. Mothers' education level is a major factor in ensuring high survival rates and healthier children with whom the schools can work.

More highly educated mothers not only produce healthier preschool children, they also produce children who are better prepared with knowledge, oral language and literacy skills upon entry into primary schooling. There is no denying the importance of preschool parent and child interaction, particularly in activities such as reading together, for the development of cognitive, oral language, and preschool literacy skills that will later serve the child well in the schools.

Finally, parents', and especially mothers' education is strongly related to children's tendency to stay in school and to achieve at higher levels. Mothers' education level is particularly important for students in the later grades of school, where more difficult assignments may make more demands on the mother's knowledge for help with homework, and where the mother's knowledge of and willingness to become involved in the schools on behalf of her children may make the difference between children's school success or failure.

The available research supports the conclusion that parents' education levels exert a strong, positive influence on family size, health, and the achievement of children in school. Additional research by the World Bank indicates that in Egypt and Thailand, mother's education level is positively related to higher aspirations for and participation in education by their daughters.[13] In these studies, mothers' aspirations for their daughters' education exceeded the aspirations of fathers.

The finding that mothers' education may lead to higher aspirations for and education of girls is significant because of recent research on education, gender and economic development.[14] This cross-national research in 96 countries "found clear evidence that in less-developed countries, especially some of the poorest, educational expansion among school-age girls at the primary level has a stronger effect on long-term economic prosperity than does educational expansion among school-age boys." All of these positive effects of women's education offer compelling arguments for greatly expanding efforts to include women in literacy and adult education programs.

GOALS 2000: The Educate America Act and Adult Literacy Education

In most industrialized nations adult literacy education is a marginalized, underfunded and poorly appreciated component of national education activities. However, data presented above argues for a more centralized role for adult literacy education in national education reform activities. The following shows how adult literacy education is related to the eight national education goals of the Goals 2000 legislation in the United States.

Goal 6 of the National Education Goals listed in the GOALS 2000 legislation is called "Adult Literacy and Lifelong Learning." It states that every American will be literate and will possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship. While Goal 6 is the only goal that focuses directly upon adults, most of the other seven goals also rest largely upon success in achieving Goal 6 if they are to be achieved.

Goal 1, "School Readiness", calls for all children in America to start school ready to learn. This places direct responsibility upon youth and adults, both parents and parents-to-be to provide proper planning for the conception of children, the prenatal care of babies, and the post-natal, preschool care and stimulation that produces children with the oral language skills and experience with literate environments that will prepare them to enter the culture of the school ready to learn. Undereducated youth and adults whose literacy skills are low will likely find it difficult to contribute to the achievement of Goal 1 unless they achieve Goal 6 - literacy.

Goal 2 calls for the high school graduation rate to increase to a least 90 percent, while Goals 3 and 5 call for greater achievement in learning by students across the grades, with an emphasis upon science and mathematics. Goal 8 calls for greater parental participation in promoting the social, emotional, and academic growth of children.

All these goals presuppose, in the general case, the literate youth and adults called for in Goal 6. The recognition that the education of youth and adults is not an incidental, marginal activity, but rather the key to accomplishing the remaining education goals offers a challenge for adult literacy education in the new millineum. It places great responsibility upon policymakers to increase their attention and resources to create a system of adult literacy education that is not a marginalized, piecemeal collection of services but is rather an integral component of the educational commitment of the nation. It places further responsibility upon adult literacy educators to develop effective programs that produce demonstrable, sustainable, useful gains in literacy and a commitment by adult students to continue their learning beyond the classroom walls.

References

[1] Benton, L. and Noyelle, T. (1992). *Adult illiteracy and economic performance.* Paris: Organisation for Economic Co-operation and Development, Centre for Educational Research and Innovation

[2] California Workforce Literacy Task Force. (1990, November).*California's Workforce for the Year 2000: Improving Productivity by Expanding Opportunities for the Education and Training of Underserved Youth and Adults.* Sacramento, CA: Senate Publications Office.

[3] Sticht, T. (1994, May). *Workplace literacy programs for ten manufacturing companies near Chicago, Illinois: A report of process and outcomes.* El Cajon: CA: Applied Behavioral & Cognitive Sciences, Inc.

[4] Brice Heath, S. and McLaughlin, M. (1993). *Identity and inner-city youth: beyond ethnicity and gender.* New York: Teacher's College Press.

[5] McDonald, B., Huie, C., Sticht, T. and Grimes, W. (1994, April). *Learning in the action research center (ARC) community: inquiry, reflection and change in the delivery system for continuing education services for adults in the San Diego Community College District.* El Cajon, CA: Applied Behavioral & Cognitive Sciences, Inc.

[6] Rosow, J. and Zager, R. (1992). *Job-Linked Literacy: Innovative Strategies at Work, Part II: Meeting the Challenge of Change: Basic Skills for a Competitive Workforce.* Scarsdale, NY: Work in America Institute.

[7] Van Fossen, S. and Sticht, T. (1991, July). *Teach the Mother and Reach the Child: Results of the Intergenerational Literacy Action Research Project of Wider Opportunities for Women.* Washington, DC: Wider Opportunities for Women.

[8] Sticht, T. and Armstrong, W. (1994, February). *Adult Literacy in the United States: A Compendium of Quantitative Data and Interpretive Comments.* Washington, DC: National Institute for Literacy.

[9] Adult Literacy and Basic Skills Unit (ALBSU). (1993a). *Parents and Their Children: The Intergenerational Effect of Poor Basic Skills.* London, England: ALBSU.

[10] Birdsall, N. and Cochrane, S. (1982). Education and parental decision making: A two-generation approach. In L. Anderson & D. M. Windham (Eds.) *Education and Development.* Lexington, MA: D.C. Heath.

[11] Sticht, T. and McDonald, B. (1990). *Teach the mother and reach the child literacy across generations.* Geneva: UNESCO International Bureau of Education.

[12] Hamadache, A. (1990). *Literacy, human rights, and peace.* Geneva: UNESCO International Bureau of Education.

[13] Cochrane, S., Mehra, K., and Osheba, I. T. (1986, December). *The educational participation of Egyptian children.* Report No. EDT45. Washington, DC: The World Bank.

[14] Benavot, A. (1989). Education, gender, and economic development: A cross-national study. *Sociology of Education, 62,* 14-32.

[15] Hollenbeck, K. (1993). *Classrooms in the workplace: workplace literacy programs in small and medium-sized firms.* Kalamazoo, MI: W. E. Upjohn Institute for Employment Research.

Chapter 2

The Literacy Skills of Adults: Assessments and Issues

If we are to make all adults in the United States literate enough to compete in the international marketplace and meet their responsibilities as parents and citizens, as called for in National Education Goal 6, how many adults are we talking about? The answer is that it is difficult to say with any degree of certainty. This is because there is not a consensus in the nation on how to define literacy, and all the existing definitions are to some extent arbitrary with respect to how standards of proficiency are set. That is, people are not typically either totally literate or totally illiterate. Rather, they fall somewhere in between. So one of the problems in determining how many adults are likely to be experiencing very difficult times due to their literacy is determining how good is good enough. This problem is illustrated in the context of the 1993 National Adult Literacy Survey (NALS) of the United States[1], modified versions of which were also used in international surveys of adult literacy in several other industrialized nations[2] (See Table 2.3, below).

The National Adult Literacy Survey (NALS)

In 1993 the National Center for Education Statistics of the U. S. Department of Education reported the results of a survey of the literacy skills of adults aged 16 to over 65 living in households in the United States. Additionally, the survey studied the literacy skills of incarcerated adults.[1] The National Adult Literacy Survey (NALS) used prose, document, and quantitative scales. Literacy scores were reported using scale scores for each of the three different types of literacy task domains. These scale scores ranged from 0 to 500.

Both people and tasks (items) were given scale scores. For instance, a person with a skill level of 210 would have a probability of .80 of performing a task that has a difficulty level of 210. However, other people with lower skill levels may also be able to perform the task, though with lower probabilities. People with skill levels of 150 have a 32 percent probability of being able to perform a task that is at the 210 difficulty level. People at the 200 level have a 74 percent probability of performing the task. People at the 300 skill level have a 99 percent probability of performing the 210 difficulty level task.

The NALS Literacy Levels

The NALS was the first national survey of adult literacy skills to report data in terms of five levels of skill.The NALS literacy levels are important because they are to be used by the National Governor's Association and the federal government to track the nation's progress on Education Goal Number 6: making all adults literate by the year 2000[3]. The goal is to get adults to Level 3 in literacy proficiency.

In the NALS, the five levels used to describe categories of proficiency include Level 1 (scale scores from 0 to 225), Level 2 (scale scores from 226 to 275), Level 3 (scale scores 276 to 325), Level 4 (scale scores 326 to 375), and Level 5 (scale scores from 376 to 500). For each of the prose, document, and quantitative scales, all those adults with scores from 0 to 225 were assigned to Level 1, those with scores from 226 to 275 were assigned to Level 2 and so forth. Table 2.1 shows the percentage of adults assigned to each of the five literacy levels for each of the three literacy scales.

Altogether, the adult population sampled represented approximately 191,000,000 adults. The data in Table 2.1 suggest that some 40 to 44 million adults are in the lowest level of skill, Level 1. Some 50 million are in Level 2, 61 million in Level 3, 28 to 32 million in Level 4 and 6-8 or so million adults are in Level 5.

Table 2.1

Percentage of adults in each of the five NALS skill levels for each literacy scale.

	Level 1	Level 2	Level 3	Level 4	Level 5
Prose	21	27	32	17	3
Document	23	28	31	15	3
Quantitative	22	25	31	17	4
Normal Curve	16	15	38	15	16

For comparison purposes, the percentage of people is given who would fall under the normal or "bell" curve at below -1 standard deviation (S.D.), between -1 to -0.5 S.D., between ± 0.5 S.D., between +0.5 and + 1.0 S.D. and above + 1S.D. The data indicate that by using the criterion-referenced standards of the NALS, the percentage of people in the lower two levels is well above what would be expected from a norm-referenced approach in which the mean and S.D. of the population is used to define levels of proficiency. The NALS approach greatly reduces the percentage of those at the highest level (Level 5).

What is The Meaning of the NALS Levels?

Being assigned to one of the five levels means that people at the average skill for a given level have an 80 percent probability of being able to perform the average tasks at the given level. For instance, the NALS report indicates that a person with a skill level of 200 would be assigned to Level 1, for which the average task difficulty is about 200 (averaged across the three literacy domains). This means that the person would be expected to be able to respond correctly to 80 percent of the average tasks in Level 1. However, this same person would be expected to be able to correctly respond to over 30 percent of the average tasks at Level 2, about 15 percent of the average tasks at level 3, 8 percent of the average tasks at Level 4 and about 5 percent of the average tasks at Level 5[1, p. 102]. This results from the fact that persons with skill levels below the difficulty level of an item may be able to perform the item correctly, though with a less than 80 percent probability of a correct response.

For example, consider a prose literacy task item that is of 279 difficulty for which a person needs a skill level of 279 to have an 80 percent probability of being able to perform the item. A person with a skill level of 250 has a probability of .62 of being able to perform the item. Because the person has a skill level of 250, on the NALS this would result in the person being assigned to Level 2. This would mean that the person has a .80 probability of being able to perform average Level 2 tasks. But note that the person would also be able to perform Level 3 tasks (which is where a task of 279 difficulty would fall), but not with as high a probability of success. In the NALS report, it is indicated that on either the prose, document or quantitative tasks, a person with a skill level of 250 can be expected to perform 50 out of 100 tasks that are at the average Level 3 task, 25 to 30 percent of the tasks at Level 4 and 10 to 20 percent of the tasks at Level 5, depending on the type of literacy scale under discussion [1p. 102].

By assigning people to a given skill level, the impression may be formed that the person has *no* ability to perform higher level tasks. But this is wrong. Even though people may be assigned to a lower skill level, this does not mean that they are totally incapable of performing tasks at higher skill levels. In the NALS survey, respondents were asked to rate themselves as to how well they thought they could read and write English. Of those categorized as Level 1 literates, some 66 to 75 percent said they could read and write "well" or "very well." The NALS authors refered to this as the "gap between performance and perception," meaning that the literacy skills of those in Level 1 are low by NALS methods of setting standards for inclusion at one or another level of skill. So the self-perceived skills of the vast majority of those categorized as Level 1 literates, who rated themselves as "well" or "very well" as literates, must be incorrect. They go on to say that "Such a mismatch may well have a significant impact on efforts to provide education and training to adults: Those who do not believe they have a problem will be less likely to seek out such services or less willing to take advantage of services that might be available to them." [1p. 20].

But it is possible that many adults labled as Level 1 literates perceive themselves as quite literate because, as indicated above, they *are* able to perform quite a few tasks at higher levels, even a few at Level 5. It must be kept in mind that simply because people are assigned to a lower level category of literacy level, this does not mean that they are entirely incapable of performing tasks at higher skill levels. They simply do not have a .80 probability of performing higher level tasks. That is, they cannot perform them with the same high level of probability that is required to be categorized at a higher level. This is important to keep in mind when one discusses the numbers of adults in the different skill levels. The numbers can be changed dramatically simply by changing the criterion for being categorized into the different levels.[4] For instance, if instead of requiring that people be able to do 80 percent of the average tasks in a given level, the criterion were changed to being able to do 70 percent of the tasks, then the numbers of people assigned to the lower levels would decrease dramatically.

By using the method of "literacy levels" to categorize people's literacy skills, one may be lead to conclude that people assigned to a given level of skill cannot perform the more demanding types of tasks found at higher levels of skill. Yet that is incorrect and provides an inaccurate indication of the full range of people's literacy skills. Quite possibly, people's perceptions of their literacy ability may be more accurate than the impressions that might be created by the use of the five NALS literacy levels.

Some Major Findings from the NALS

The NALS reported data on the literacy scores of adults across a wide range of age, for persons with special health conditions, for ethnic groups, and for incarcerated populations. Some of the key findings for each of these groups are summarized below.

Literacy and Age. The NALS report indicated that, generally, both education and literacy skills increased for adults from ages 16-18 up to ages 40-54, and then skills dropped rapidly. Adults 55 -64 and those 65 or older performed well below the levels of younger adults, even though their average years of education was not much different from the 16-18 year olds. Summarizing across the three literacy scales, about 44-48 percent of those adults categorized in Level 1 were aged 55 or older, and 32-35 percent were 65 years old or older. Some 28-32 percent of those in Level 2 were 55 years old or older, and 16-18 percent were 65 or older.

From the NALS data it is not possible to say whether adults' literacy skills rise and then decline or whether the various age groups have performed at the levels indicated throughout adulthood. This would require longitudinal studies. However, referring to the human cognitive system of page 28 of this report, the NALS tasks do impose heavier burdens on working memory as they increase in difficulty. In fact, this may be one of the major reasons the tasks increase in difficulty. The authors of the NALS report note that, of several variables that might make tasks more difficult, two of the variables for prose and document tasks are the number of categories or features of information that the reader has to process or match, and the number of categories or features of information in the document that can serve to distract the reader or that may seem plausible but are incorrect. In the quantitative tasks, the number of operations needed to perform the task is given as a factor that may influence the difficulty of the task[1pp. 74, 85, & 94].

Generally, holding features or categories of information in short term or working memory and then searching through other information places greater demands upon working memory, and there is considerable evidence that working memory performance declines with increasing age[5p. 401]. This may explain, at least in part, the decrease in literacy skills as age increases.

One of the factors that is important for literacy is one's organized bodies of knowledge. The bodies of knowledge are what makes it possible to comprehend printed displays, to reason analogically (i.e., from one body of knowledge to another), and to make inferences (i.e., going from the information given in the display to another body of knowledge in one's mental knowledge base to create yet a third domain of knowledge needed to correctly perform an inference-type task). Generally, these organized bodies of knowledge continue to develop across adulthood and tend to resist deterioration in older age [5p. 401]. While the NALS includes tasks that include knowledge content from health, consumer economics, and others, it does not systematically assess people's organized bodies of knowledge in any domain (e.g., health, science, government, etc.). It is not possible to know whether poorly performing people's primary problems may be their lack of knowledge (e.g., vocabulary, concepts, etc.) or of working memory control, or both. But the rapid decline in performance with ages above 55 suggests a strong component of working memory control in the NALS tasks.

Health Conditions. A major contribution of the NALS was the sampling of adults with various forms of physical, mental or other health conditions. The survey reported that 12 percent of the adult population reported some type of health problem. Significantly, as a type of epidemiological indicator of the self-perceived extent of adult learning difficulties in the U. S. population, some 3 percent (7.5 million) adults reported that they suffered from learning disabilities. Around 60 percent of these adults scored in Level 1, and some 22 percent scored in Level 2. Overall, the average scores for those self-reporting that they had a learning disabilty were: prose-207; document- 203; and quantitative- 200.

Less than one-half of one-percent reported that they were mentally retarded. Eighty-six to 89 percent of these adults were placed in Level 1, with average scores of: prose-143; document-147; and quantitative- 117.

Race/Ethnicity . The NALS provides the most extensive data on the largest numbers of race-ethnic groups of any previous survey. Table 2.2 shows the percentage of race-ethnic groups falling into each of the five levels of the NALS prose scales. Large percentages (20-89) of Hispanics from the various regions were born outside the United States and generally had Spanish as their primary language. For the most part, the Hispanic groups with large numbers born outside the United States performed more poorly than Blacks on the literacy scales. Because Hispanics born in the United States are more likely to speak and read English, their scores are higher on the literacy scales. For instance, the Hispanic/Other category includes those who were mostly (68 percent) born in the United States, and their scores are higher than the scores for Blacks. Large percentages (78) of Asian/Pacific Islanders were also born outside the United States. A category of "Other" is also given in the NALS report but is not included in Table 2.2.

Across the age span, Hispanics (grouped together) had fewer years of education (average of 10.2 years) than did Whites (12.8) or Blacks (11.6). Through ages 55-64 Asian/Pacific Islanders had the most years of education (average of 13 years), while among those over age 65, Whites had the most education.

Table 2.2 Percentage of race/ethnic group members in each of the five NALS skill levels for the prose literacy scale.

	Level 1	Level 2	Level 3	Level 4	Level 5	Average Proficiency
White	14	25	36	21	4	286
Black	38	37	21	4	0*	237
Hispanic: Mexicano	54	25	16	5	0*	206
Puerto Rican	47	32	17	3	0*	218
Cuban	53	24	17	6	1	211
Central/So. America	56	22	17	4	0*	207
Hisp. Other	25	27	33	13	2	260
Asian/Pacific Islander	36	25	25	12	2	242
Amer. Indian Alaskan Nat.	25	39	28	7	1	254

* percentages less than 0.5 rounded to zero.

Incarcerated Population. The NALS included a national sample of inmates in federal and state prisons. The sample confirmed what is widely understood in showing that the prison population tends to be quite different demographically than the general adult population. For example, the prison population was mostly males (94 percent), 80 percent were below the age of 40, they were less White (35 percent), more Black (44 percent) and Hispanic (17 percent), and less well educated (49 percent with less than a high school education).

The prison population scored lower on literacy than the general adult population. The average scale scores for the three literacy scales were: prose-246 (272 for the general adult population), document-240 (267 general adult population), and quantitative-236 (271 general adult population). In terms of the NALS literacy levels, looking across the three literacy scales, some 31 to 40 percent of inmates were in Level 1, 32-38 percent in Level 2, 22-26 percent Level 3, 4-6 percent Level 4, and less than 0.5 to 1 percent in Level 5.

Poverty, Income ,Occupational Status, and the Intergenerationl Transfer of Literacy. The NALS confirmed other studies going back over the decades in showing that the less literate are more likely to be found in poverty, on welfare, unemployed or employed in poorly paying jobs, and in the lower status jobs that require less education.

The intergenerational effects of parent's education level on the adult's lteracy level was also found in the NALS . Adults whose parents had completed a four year college degree were nine times more likely to have completed a college degree themselves than were adults whose parents had 0-8 years of education (46 percent versus 5 percent).Thirty-two percent of adults whose parents had completed 0-8 years of education had themselves completed only 0-8 years of education, whereas only 5 percent of adults whose parents had completed high school reported that they themselves had completed only 0-8 years of education.

Are the literacy skills of America's adults adequate ?

One of the most important things that the National Adult Literacy Survey (NALS) of 1993 was to do was to provide "...an increased understanding of the skills and knowledge associated with functioning in a technological society."

When the NALS research report directly raised the most important question about literacy and functioning in our technological society, the question that must have motivated the U. S. Congress to ask for the survey in the first place, and the question surely of most interest to corporate America, labor unions, adult educators, and adults themselves, the answer was, at best, disappointing. The report asked, "Are the literacy skills of America's adults adequate? That is, are the distributions of prose, document, and quantitative proficiency observed in this survey adequate to ensure individual opportunities for all adults, to increase worker productivity, or to strengthen America's competitiveness around the world? " [1p. xviii]

The NALS authors then went on to answer the question. "Because it is impossible to say precisely what literacy skills are essential for individuals to succeed in this or any other society, the results of the National Adult Literacy Survey provide no firm answers to such questions." [1p. xviii] In short, the most important question from a policy point of view was not answered by the NALS (nor has it been answered prior to or since the NALS).

The Arbitrary Nature of Competency Standards. As noted above, in reporting the 1993 National Adult Literacy Survey (NALS) data, the developers assigned adults to five different levels - 1 (low) through 5 (high). To qualify to be at a given level, the arbitrary decsion was made that an adult had to have an 80 percent (p=.80) chance of being able to perform the average task at the given level. Following this decision rule, some 20 percent of adults were placed in Level 1, while 27 percent were placed in Level 2 (prose scale). This led to the quote in many newspapers that "half of America's adults are functionally illiterate!" A sentiment subsequently expressed internationally by leaders in Japan.

But the NALS data also showed that, although adults with skills of 200 were assigned to Level 1, because they could do 80% of the average tasks at that level, they could actually do 45% of the tasks at Level 2, 25% of those at Level 3, and even 15% (one in six) of those in Level 5. Adults with scores of 250 were assigned to Level 2, and it was implied that they could not perform more difficult tasks, even though they could do half (50%) of the tasks at Level 3, and one in five (20%) of the tasks at Level 5, the highest level of difficulty. But by being called Level 2 adults, all competence above that Level was (at least implicitly) denied to them.

Other Widely Used Standards Reduces Numbers of Adults in Levels 1 and 2 Dramatically. In a study of issues surrounding the setting of standards for adult literacy[4], Kolstad reported analyses showing that in the grade schools, the National Assessment of Educational Progress (NAEP) reports children's proficiency levels using a .65 probability of being able to perform the average task at the given level. Applying that standard to the NALS prose scale data reduces the percentage of adults in Level 1 from 20 to 13 percent , and those in Level 2 drop from 27 to 19 percent. Altogether then, the percentage of adults below Level 3 drops from 47 to 32 percent, a 15 percent drop in adults considered marginally literate just by adopting for adults the same standard that is used for children in the K-12 school system!

The widely-used Comprehensive Adult Student Assessment System (CASAS) uses a probability of .50 to indicate a person's proficiency level. Applying the same standard to the NALS reduces the percentages in Level 1 from 20 to 9 percent, and in Level 2 from 27 to 13 percent. Combined, this reduces the percentage of adults below Level 3 by 25 percent, from 47 to 22 percent, or about one in five American adults in the lowest literacy level.

These new analyses about the rather arbitrary nature of standards for literacy led Kolstad to state, "A factor that has such a large impact on the results deserves a thorough understanding of the issues and debate over the standard to be adopted." This debate has yet to happen in adult education. Still, the question of "how good is good enough?" has been answered in practice by the National Governor's Association. It has established the national goal as getting all adults to score at Level 3 on the NALS scales. A daunting task given the fact that some 90 million adults are below the national standard.

International Comparisons

A 1995 report from the Organization for Economic Co-operation (OECD) and Statistics Canada reported the results of testing of adults on NALS-type tests in different countries.[2] Table 2.3 shows the results for each of the three scales (prose, document, quantitative) in five of the countries that participated in the study.

Table 2.3. Performance of adults in four countries on prose, document and quantitative scales of the National Adult Literacy Survey (NALS) developed in the United States.

Levels:	1			2			3			4/5		
Country	Prose	Doc.	Qnt.	Prose	Doc.	Qnt.	Prose	Doc.	Qnt.	Prose	Doc.	Qnt.
United States	20.7	23.7	21.0	25.9	25.9	25.3	32.4	31.4	31.3	21.1	19.0	22.5
Canada	16.6	18.2	16.9	25.6	24.7	26.1	35.1	32.1	34.8	22.7	25.1	22.2
Germany	14.4	09.0	06.7	34.2	32.7	26.6	38.0	39.5	43.2	13.4	18.9	23.5
Sweden	07.5	06.2	06.6	20.3	18.9	18.6	39.7	39.4	39.0	32.4	35.5	35.8
Poland	42.6	45.4	39.1	34.5	30.7	30.1	19.8	18.0	23.9	03.1	05.8	06.8

Addendum: Test Score Conversions

Many adult programs do not use the NALS-type tests for measuring improvements in learning. In these programs, it may be desirable to identify correspondences among different adult literacy education tests so that cross-program comparisons can be made and progress toward the goal of having adult literacy students reach Level 3 of the NALS can be estimated from various tests. Following is a brief conversion chart for finding rough correspondences among the scale scores of the Comprehensive Adult Student Assessment System (CASAS), the reading grade level scores of the Adult Basic Learning Exam (ABLE) and the Tests of Adult Basic Education (TABE) and scale scores from the Tests of Adult Literacy Skills (TALS) scores, which are the same as the National Adult Literacy Survey (NALS) scores. Scores in between those given can be obtained by drawing a graph with CASAS scores on the x axis and ABLE scores on the y axis and plotting the x and y data points in the chart. Then connect the plotted data points with a straight line. The same can be done for the other tests. Any correspondences needed can then be read off of the graph.

These data are based on studies in which the correlations between the CASAS and the other tests are in the .70 area. This leaves lots of room for variations in estimates. It is best to think of these scores as rough indicators of people's skills, perhaps as low, medium and higher levels. Keep in mind that we are not talking atomic clock accuracy when we measure adult literacy with any of these tests!

Conversion Chart

If CASAS score is 200, then ABLE score is 3.9; TABE score is 4.2, TALS score is 178.

If CASAS score is 215, then ABLE score is 6.6, TABE score is 7.0, TALS score is 229.

If CASAS score is 225, then ABLE score is 8.5, TABE score is 8.8, TALS score is 260.

If CASAS score is 230, then ABLE score is 9.4, TABE score is 9.8, TALS score is 279.

Conversion for CASAS to ABLE and TABE scores is described in Sticht [6] and for CASAS to TALS (or NALS) in Haney et. al.[7]. The estimate is from Table 6.1 of that report and is the average of four different methods given for converting CASAS to TALS scores.

References

[1] Kirsch, I., Jungeblut, A., Jenkins, L. & Kolstad, A. (1993, September). *Adult Literacy in America: A First Look at the Results of the National Adult Literacy Survey*. Washington, DC: U. S. Government Printing Office.

[2] Organization for Economic Co-operation and Development & Statistics Canada. (1995). *Literacy, Economy, and Society: Results of the First International Adult Literacy Survey*. Paris: Organization for Economic Co-operation and Development .

[3] National Education Goals Panel (1992). *The National Education Goals Report: Building a Nation of Learners*. Washington, DC: U. S. Government Printing Office, pp. 40-43.

[4] Kolstad, A. (1996, April). *The response probability convention embedded in reporting prose literacy levels from the 1992 National Adult Literacy Survey*. New York: Paper presented at the annual meeting of the American Educational Research Association.

[5] Bernstein, D., Roy, E., Srull, T & Wickens, C. (1988). *Psychology*. Boston: Houghton Mifflin.

[6] Sticht , T. (1990, January). *Testing and Assessment in Adult Basic Education and English as a Second Language*. Washington, DC: U. S. Department of Education, Adult Literacy Clearinghouse.

[7] Haney, W. et. al. (1994, October). *Calibrating scores on two tests of adult literacy: An equating study of the Test of Adult Literacy Skills (TALS) Document Test and the Comprehensive Adult Student Assessment System (CASAS) GAIN Appraisal Reading Test (Form 2)*. Chestnut Hill, MA: Boston College.

Chapter 3

Some Challenges of Diversity for Adult Literacy Education

The design of functional context education and training programs for out-of-school youth and adults, many of whom may be undereducated and not well developed in English language and literacy skills is made difficult by the great diversity of adults as individuals and by the situational and organizational contexts in which adults are found. Because of this diversity, adult educators need to possess an extensive body of knowledge and professional training.

The Diversity of Adult Learners

As suggested in the preceeding chapter, adult language and literacy learners form a breathtakingly diverse group. Among others, it includes college students taking English courses at the university, new immigrants who need to learn the English language as a second language, out of school, native born adults who are seeking to develop basic and intermediate language and literacy skills and mature adult employees who need to upgrade their language and literacy skills in the wake of changes in their work environments.

Immigrants/ Foreign Born

Immigrants arriving in the United States frequently enroll in English as a second language (ESL) programs. The diversity of educational backgrounds among these new arrivals is extensive; some have higher education degrees, others are without formal education and are totally illiterate in any language, and thousands of others fall in between these extremes. They are all grouped together by their need and desire to learn to speak, read and write the English language of their newly adopted homeland.

A U. S. Department of Education [1] (pp. 15-22) study reports that during 1991-92, federally funded adult education programs enrolled about 756,000 adults in English as a second language (ESL). Almost all of these adults were foreign-born, and about half had arrived in the United States after 1990. Sixty-seven percent of the ESL enrollees were Hispanic, 22 percent Asian/Pacific Islander, 8 percent White, non-Hispanic, 2 percent Black, non-Hispanic, and slightly less than 1 percent were American Indian/Alaskan Native.

Over half (53 percent) of ESL enrollees had attained at least a high school education, another 23 percent had completed a postsecondary (four year college) degree, and 47 percent had no high school diploma . About 92 percent said they read "well" or "very well" in their native language, while 8 percent said they read "not at all" or "not well" in their native language. The ability to read in their native language was directly and positively related to their ability to speak English.

Sixty-two percent were under age 30, and only 11 percent were over age 40. Most (51 percent) had never married and 63 percent had no children living in the household. About a third of the ESL students with young children in the household reported that they provided some intergenerational transfer of literacy by reading with their children nearly every day.

Committed as they must be to meeting the demands of daily living while still spending precious hours in learning the English language, these new citizens-to-be pursue this study openly, with the admiration and encouragement of their families, friends, and, for those lucky enough to find work, their employers.

Native Born Adult Learners

The undereducated, native born citizens of the United States include those for whom life has been rough, for whom learning in school may have been very difficult, leading to a decision to dropout of school without having achieved higher levels of language or literacy, those for whom decisions made in the passions of youth brought an early parenthood and an existence on welfare, or those engaged in jobs where new ways of work have upgraded the demands for language and literacy skills. These are the adult learners who are stigmatized in the mass media as the "functionally illiterate."

For these learners there is frequently little joy in "going back to school." Unlike those studying English as a second language, the native-born who seek basic literacy education often feel that there is nothing to be proud about in going for "remedial" education. Too often for these adults, language and literacy learning is an embarrassment - an activity to be concealed. In these cases, the design of the instructional environment may include changing loss-of-face names like "adult literacy program" to face-saving names like "job skills enhancement program." Participation in these adult education programs is often clandestine, and not to be divulged to one's families, friends, or employers.

The U. S. Department of Education[1](pp. 22-29) reported that, in federally funded adult education programs, about 414,000 adults enrolled in Adult Basic Education (ABE) and 612,000 in Adult Secondary Education (ASE) during fiscal year 1991-92. Over 90 percent of these enrollees were U. S. citizens by birth, most (61 percent) were White, non-Hispanic, while Black, non- Hispanic (22 percent), Hispanic (12 percent), American Indian/Alaskan Native (3 percent) and Asian/Pacific Islander (2 percent) made-up the remainder of the ethnic distribution of the enrollees.

For 82 percent of the ABE/ASE adult students, English was the language spoken at home, Spanish was the next most frequent language spoken in the home. Over two-thirds (68 percent) of the ABE/ASE students were under age 30, and only 8 percent were over age 45. Most (61 percent) were women, most (52 percent) had never been married, and most (63 percent) had no children in the house under the age of 6. Those with young children (about 37 percent) said that they read with their childrern about once a week on average.

The typical ABE/ASE adult student dropped out of school after completing 10 years of schooling. Eighty-nine percent had no high school diploma, 8 percent had a diploma, and 3 percent had a postsecondary degree.

A local perspective. In San Diego, research was conducted to better understand the education of adults in an inner city, economically depressed area served by four continuing education centers that are part of the San Diego Community College District, Continuing Education Division .[2] District data indicate that of 28,822 adult students served from 1992-93, 90 percent were ESL students and only 10 percent were ABE students. This may reflect the negative feelings that frequently accompany "going back to school" that many native-born adult students report [2] (pp. 35-36).

The diversity of ESL clients in the San Diego study sites is much greater than that suggested by the U. S. Department of Education report. At just one of the four adult continuing education centers where research is underway, enrollment data show that there are learners from 108 different nations, speaking over 70 languages. In the centers involved in the study, there are large enrollments in beginning ESL, and then enrollments plummet and very few adults are found in advanced ESL, possibly because they are able to gain employment with lower levels of language skills[2] (pp. 25-34). Whatever the case, these new immigrants are an inspiration to adult educators. Many are here in the United States studying to become citizens, American-style parents, workers, and friends with their new neighbors. Many have survived the horrifying experiences of famine, floods, war, genocide, infanticide, wife-burning, and extreme poverty in their native lands.

In San Diego, as in the rest of the nation, the awesome task of the adult educator is to design instructional environments that will serve well this diverse population of language and literacy learners.

The Diversity of Instructional Contexts

The adult educator's task is made even more difficult because diversity is also constituted by the contexts in which adults learn. Unlike children, who face and meet compulsory education demands by attending our more or less homogeneous public schools for 12 to 13 years, adult language and literacy learners are not typically faced with compulsory education, nor are they neatly housed in schools. The various situational and institutional contexts in which adult learners may be found constrain the types of instructional environments that adult educators can provide.

Self Instructional Programs

Adults may choose to learn in a variety of contexts. They may study alone at home, using language tapes, computer software, books, or even products such as Hooked on Phonics™ with SRA™ kits ("used by over 62 million people around the world") that use the mass media of television and radio to bombard the airwaves with advertising aimed at the adult learner/consumer.

Adult learners may be attracted to such products because they offer flexibility in terms of time of use, number of repetitions of a lesson, and, perhaps of most importance for the adult literacy student, anonymity. Adult educators may be engaged in developing these types of products for self-study. With such materials, it is important to keep the operating instructions as simple as possible, so that non-English speaking or less literate adults are able to use the products. In language learning, there must be special attention given to providing information feedback to the learners so they can know how well they are doing and whether they are proceeding correctly in areas such as pronunciation and appropriateness of syntax and vocabulary.

Military Contexts

Educators working in military contexts are strictly bound by the amount of time that is provided for instruction. Such time pressures may be even greater under a major mobilization like the Vietnam war. Military management may provide as little as 45 hours or as much as three months for an instructional program in reading or mathematics, depending upon the circumstances. Socialist, Marxist or "critical literacy" aimed at overthrowing the hegemony of the governing classes through revolution are notions that are not typically valued as goals of military literacy programs. Instead, it is generally expected by military management that the program will produce measurable improvements in job tasks requiring reading or mathematics.

In such cases, the adult educator may have to work with adult learners whose participation in the program is mandatory, whose full time is dedicated to learning in the program, and who often may be exhausted from overnight training activities. The educator may have to develop or use existing job-related materials to accomplish a significant amount of literacy development in a fairly narrow domain in a brief amount of time. Nationally normed and job-related tests may have to be administered to document learning gains in the programs.

In 1980-81, when the military was enlisting only volunteers and spending billions of dollars to recruit higher ability personnel, they were still providing basic skills instruction to over 220,000 service members, which was equivalent to all the basic skills enrollments in 25 of the United States [3] (Table 16, p. 47). With the end of the cold war and the downsizing of the military services, there are fewer enrollments in basic skills courses, but as recently as 1990 the military provided literacy instruction for over 75,000 thousand adults[4] (appendix). Adult educators need to be prepared to work in military contexts to meet the needs of both the service members and their organizations.

Jails and Prisons

As sad as it is to say, one of the "growth" areas for adult language and literacy providers are the thousands of city jails and state and federal prisons, so-called "correctional" institutions, that have and continue to proliferate throughout the United States. With over a million prisoners behind bars, perhaps most of whom are undereducated, adult educators must understand the cultural contexts of institutions that many view as existing to punish, not rehabilitate [5] (p. vii).

In his study of education in jails, Erickson[6] noted that prisoners may be highly transient, shuffled among different facilities, and released and readmitted repeatedly. They may be able to grab only a few hours of instruction at one facility before being moved along to somewhere else. Guards and other personnel may resent the educational opportunities of prisoners, taunt them and discourage learning. The prevalence of violent gangs may limit the work of the adult educator because gang leaders may discourage participation in education.

Unlike the military, where specific organizational outcomes in the form of improved job-related reading and math skills are expected, many correctional institutions have no particular institutional goals for education, but rather a less direct outcome in mind - lowered recidivism. To this end, institutions are likely to look more favorably on those programs that help prisoners make successful transitions into civilian life than those that are oriented toward "improving one's potential" in some rather abstract sense.

Adult educators must be prepared to work in correctional institutions under conditions of what is often heavy-handed security, including censorship of materials, that limit what they teach and how they teach it. In jails, brief, self-contained lessons, perhaps computer-based, focused on a particular topic may be useful in working among the highly transient inmates. In prisons, where long-term programs may be possible, programs aimed at improving self-image, such as high school completion, or integrated basic skills, life skills and vocational skills may be desired and developed by the adult educator to help improve each prisoner's personal potential, to contribute to a more successful transition to civilian life and to lowered recidivism [5] (p.37). In accomplishing the latter, it is essential that adult educators coordinate "inside" educational programs with "outside" programs that aid in prisoner reentry into civilian life.

The Job Corps

The War on Poverty of the 1960's produced many intervention programs for youth and adults. Vocational training was the major focus of many youth programs, with some attention to remedial academic education, and perhaps attainment of a high school equivalency degree. The most prominent and enduring of these programs was the Job Corps, which is still in operation.

Adult educators who wish to work in Job Corps centers teaching literacy skills must be prepared to follow a highly systematized, competency-based, computer-managed instructional (CMI) program developed, in part, to meet the demands of the "open entry/open exit" policy of the Job Corps that permits students to start or leave the program whenever they want. The CMI system tests students and analyzes student's needs for basic skills instruction. Teachers can assign instructional materials according to this computer test analysis. For instance, based on a student's reading level, appropriate math instructional materials can be assigned. Progress tests are scored and recorded automatically by the CMI system so students can progress rapidly through the program. With the CMI system, it is expected that teachers can spend less time on record keeping and more on working with students individually or in small groups.

In 1991-92, participants in the Job Corps were economically disadvantaged, mostly male (2/3), high school dropout (80%), minorities (2/3) who had never been employed. Reading skills on entry were around the 7th grade level and they improved in an average length of stay of 7.6 months to around the 8.4 grade level [7]. In terms of the National Adult Literacy Survey levels, this means that the Job Corps members enter and leave in Level 2, below the Level 3 standard set by the National Governor's Association.

Workplace Learning Contexts

Partnerships of educational providers and various businesses sometimes develop and conduct basic skills (English as a second language, reading, writing, mathematics) programs for employees. As in the military, socialist, Marxist or "critical literacy" aimed at destroying capitalism and replacing management with labor through revolution are notions that are not usually valued in such programs. Rather, they generally have to conform to traditional values of "the American work ethic" and be consistent with the concepts of capitalism, competitiveness and private enterprise. The programs may be expected to produce changes not only in employees basic skills, but also in one or more aspects of their productivity on the job. Funding agencies that govern program development may require that the language and literacy programs be developed using materials relevant to the jobs done in the workplace, though this does not apply to programs for completing the General Educational Development (GED), high school equivalency certificate.

In workplace-based programs, if the education is on duty time, the adult educator will frequently have to develop brief (20-50 hour) programs because employers cannot afford to spare employees off a production line or from another position for long periods of time. Classes may be run on or off duty from midnight to eight in the morning or at other odd hours to match the shifts that employees are working. Classes may be held in well furnished and quiet offices, noisy, makeshift space in the company cafeteria, or specially designed learning centers fully equipped with text, video and audio materials, computers, and audiovisual equipment.

Recent research on workplace literacy programs suggests that such programs may, indeed, contribute not only to improving adults' literacy and numeracy skills, but also to improving productivity on the job . In one recent study, six manufacturing companies in the area of Chicago, USA, making products ranging from hydraulic valves to bubble gum, provided basic English language, reading and mathematics education for over 700 employees [8]. In evaluation studies conducted in the companies, supervisors reported that the programs had a variety of positive effects on organizational effectiveness, including improvements in training, on the job performance, promotability of participants, and productivity, such as scrap reduction, reduced paperwork, less wastage and other efficiencies. In turn, employees reported that the language and literacy programs had helped them on their job, at home and in their communities. Some were stimulated to continue their educations at local community colleges.

Community Colleges and Adult High Schools (Local Education Agencies)

Approximately 1.8 million adults enrolled in 1991-92 in federally-funded English as a second language (ESL), adult basic education (ABE), or adult secondary education (ASE) programs. Ninety four percent of ESL and 85 percent of ABE/ASE adult learners enroll in public school systems (local education agencies) or community colleges [1] (pp. i, 21,28).

Community colleges and adult high schools are typically state-funded, bureaucracies which scramble to get Full Time Equivalents -FTE's. FTE's are the number of student contact hours that would be obtained with a full time student. FTE's are typically based on average daily attendance, and because adults are not usually full-time students in ESL, ABE, or ASE programs, it may take quite a few adults to make-up one FTE.

In a "teacher as researcher " study conducted in the San Diego continuing education centers mentioned above, in one classroom over 80 adult students came and went during a semester to make up an average daily attendance of 22 students [9]. The latter is the number required to conduct the class and if there are not 22+ students enrolled at the outset of class, the class is canceled and the teacher may be out of a job for the semester.

This uncertainty of enrollments and availability of funds for classes has led many institutions to hire part-time teachers who work without health or retirement benefits. In the San Diego continuing education centers where research is underway, in 1993 there were 63 full-time and 523 part-time teachers. The uncertainty inherent in this system leads to staff morale problems and frequent hardships for teachers who may have to work two or three jobs to support their families. This may detract from the quality of education that can be delivered, and it makes it difficult to get many of these adjunct teachers to attend staff development activities on a voluntary basis.

Because of the transient nature of many adult students, due to work schedules, problems with transportation and child care, and other personal problems, many community colleges and adult schools run what are known as "open entry/open exit" classrooms in which adults may enroll at any time and drop out at any time (as in the Job Corps). Needless to say this demands a great deal of flexibility on the part of the teacher and the other students to constantly accommodate newcomers. It may limit the propensity to engage in cooperative group or team projects. It has also led to the development of "learning centers" in which teachers may act more as facilitators of self-study activities by directing students to appropriate workbooks, audio tapes, videos, or computer programs.

Community Based Organizations (CBO's)

There are a large number of community based groups that are typically non-profit, charitable organizations that provide a variety of services to community residents, often including ESL, ABE, and ASE. About four percent of ESL and five percent of ABE/ASE adult students funded by the Adult Education program of the U. S. Department of Education enrolled in CBO's in 1991-92 [1] (pp. 21,28).

Many of these organizations have sprung up to serve the educational needs of particular segments of the adult population for whom special laws, policies and funding have been provided by various government agencies. For instance, the Association of Farmworker Opportunity Programs includes thirty-seven CBO's in forty-eight states and Puerto Rico who provide disadvantaged migrant and seasonal farmworkers (MSFW) with education, training, and employment opportunities. These organizations are funded through the Department of Labor's Job Training Partnership Act (JTPA), Title IV §402[10] (p. iv). In program year 1991, some 50,000 farmworkers were served in the MSFW program. About 45 percent of these workers received classroom training [11] (p. 1-6).

While CBO's that receive federal and state funds are typically constrained in various ways by the rules and regulations of the laws governing their funding sources, many CBO's exist that are completely independent of any government agencies and operate with the extensive use of volunteers and funding by public donations. Organizations such as Laubach Literacy Action and Literacy Volunteers of America (LVA) may sometimes work with government grants, but in principle they are independent, charitable organizations funded through memberships and the benevolence of generous and caring individuals, businesses, and private foundations. In 1992 Laubach served some 147,000 students with 98,000 tutors, while LVA served 65,000 adults with 55,000 tutors and administrators [12] (pp. 6-7).

Many community based organizations are involved in the new family literacy initiatives of the federal government's Even Start legislation or the work of the National Center for Family Literacy [13]. Such programs bring a new dimension to adult education because adult educators must work with and learn something about early childhood education to promote the intergenerational transfer of new language and literacy skills from parents to their children [14,15].

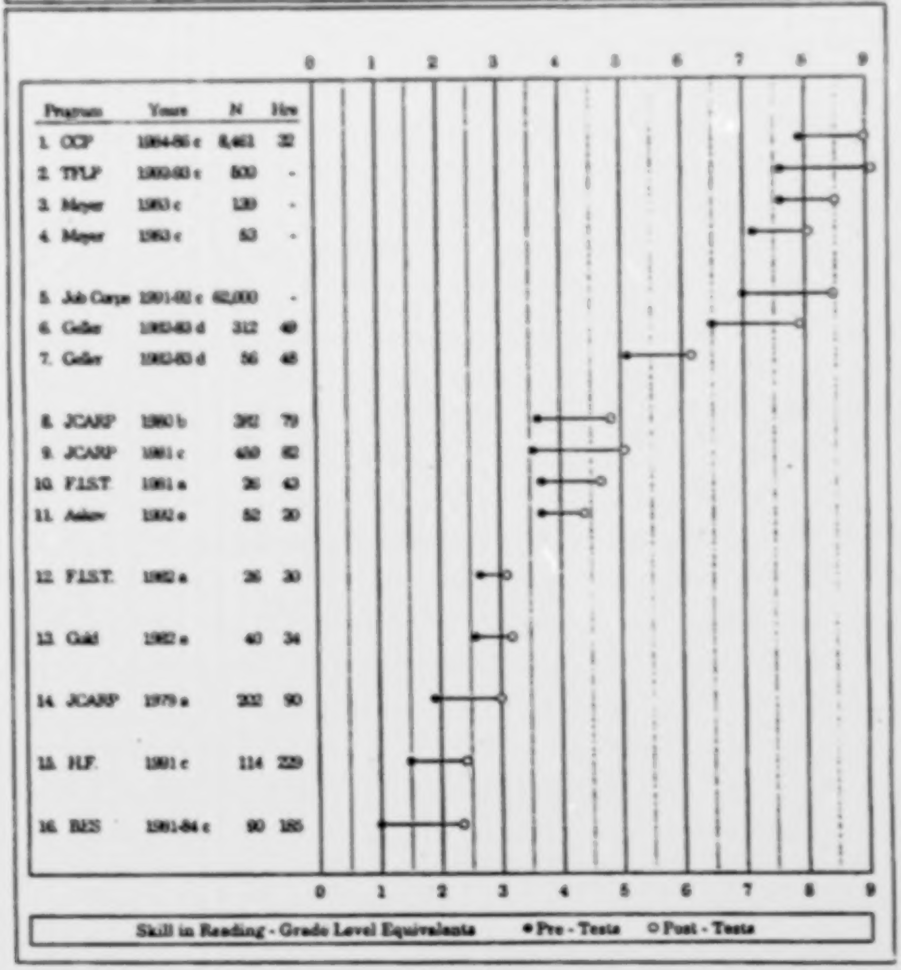
Diversity of Learning Outcomes

Not surprisingly, perhaps, the diversity in students, faculty, and facilities in adult literacy education programs results in a diversity of learning outcomes. This is illustrated by the data on pre- and post-tests for sixteen programs from different parts of the United States presented in Figure 3.1.[16] The programs depicted represent an odd lot of programs that followed different approaches from 1982 to 1992. They measured reading skills using five different tests, though most used the Tests of Adult Basic Education (TABE).

Programs numbered 8,9,14, and 16 were designated as "exemplary" by the U. S. Department of Education's Joint Dissemination Review Panel. Programs 5 and 10 used computer-based instruction. Program 1 summarized data from several hundred sites across the nation that used the competency-based approach of the Comprehensive Competencies Program (CCP). Programs 4,5, and 6 were offered in Job Corps centers. Programs 2,3, and 12 were offered in correctional institutions.

It is apparent from Figure 3.1 that there is little relationship among entry level scores and gain or hours of instruction and gain. The 82 hours of instruction in program 9 produced more gain than the 185 hours of instruction in program 16, but about the same gain as the 49 hours of instruction in program 6. Gain in the 1979 JCARP (program 14) was about 1 "year," while the JCARP of 1981 (program 9) reported 1.5 "years" gain. However, the JCARP did not follow the standardized procedures for the Tests of Adult Basic Education (TABE) and hence the accuracy of pre- and post-test scores and the reliability of the gain is suspect.

Figure 3.1 Adult Basic Education Programs: Achievement Gains



Across the sixteen programs of Figure 3.1, improvements in adult literacy skills ranged from about 0.5 to 1.5 "years" of gain in anywhere from 20 to 229 hours of instruction using a variety of measures. Additional analyses of multi-year data from California, Illinois, and New York city show that programs typically make 0.5 to 1.5 "years" gain in anywhere from one to over 100 hours of instruction, with little relationship of hours of instruction to gain, or to whether programs claimed to represent "whole

BEST COPY AVAILABLE

language" or "eclectic" approaches (as evidenced by data from Illinois in particular).[16] None of these studies corrected gains for regression effects that happen whenever persons who score low on standardized tests are separated out for treatment and then retested as a separate group from all those who took the pre-tests. Regression effects have been found to produce gains up to 1.0 "years" just by retesting low scoring people with no literacy education in between pre- and post-tests.[17p.116, 18]

In the national evaluation of the Even Start family literacy program in the U. S., it was found that adults in the Even Start programs made 3.7 scale score points gain (about 7 months in reading grade levels) on the Comprehensive Adult Student Assessment System (CASAS) tests of reading, while a control group made 3.6 scale score points gain. This lead the evaluators to conclude that, "...the gains for the Even Start adults are not appreciably larger than those of the control group." While all of the Even Start adults had participated in adult literacy instruction between pre- and post-tests, only about a quarter of the control group had attended some adult literacy education during the experimental study.[19, pp.185-187] There were statistically significant, positive relationships of gain to hours of instruction in the Even Start programs. As the Even Start evaluation report noted, in general, the gains made in the Even Start programs were comparable to those made in other adult literacy education programs, including the family literacy progams of the National Center for Family Literacy.

In the largest and most comprehensive study of adult literacy education programs in the United States, it was found that for English as a Second Language (ESL) students who stayed in programs for an average of 120 hours, pre-test scores on the Comprehensive Adult Student Assessment System (CASAS) went from 207 to 212 for a statistically significant gain of 5 scale score points. In reading grade levels, the ESL students went from reading at about the 5.5 grade level to the 6.5 grade level. About a one year gain.[20pp.25-26]

Adult basic education students went from the 6.1 reading grade level on the Tests of Adult Basic Education (TABE) at the pre-test to the 7.4 grade level on the post-test for a gain of 1.3 grade levels after an average of 84 hours of instruction.[20pp.25-26] Students in adult secondary education, those preparing for the high school equivalency examination, went from the middle of the eighth grade (8.5) to the mid-ninth grade (9.3) for a gain of 8 months in an average of 63 hours of instruction. [20pp.25-26]

Longitudinal studies. Finding systematically gathered and reported data on pre- and post-test scores in which adult literacy students have been repeatedly post-tested to determine their growth in literacy ability over time is extremely rare.

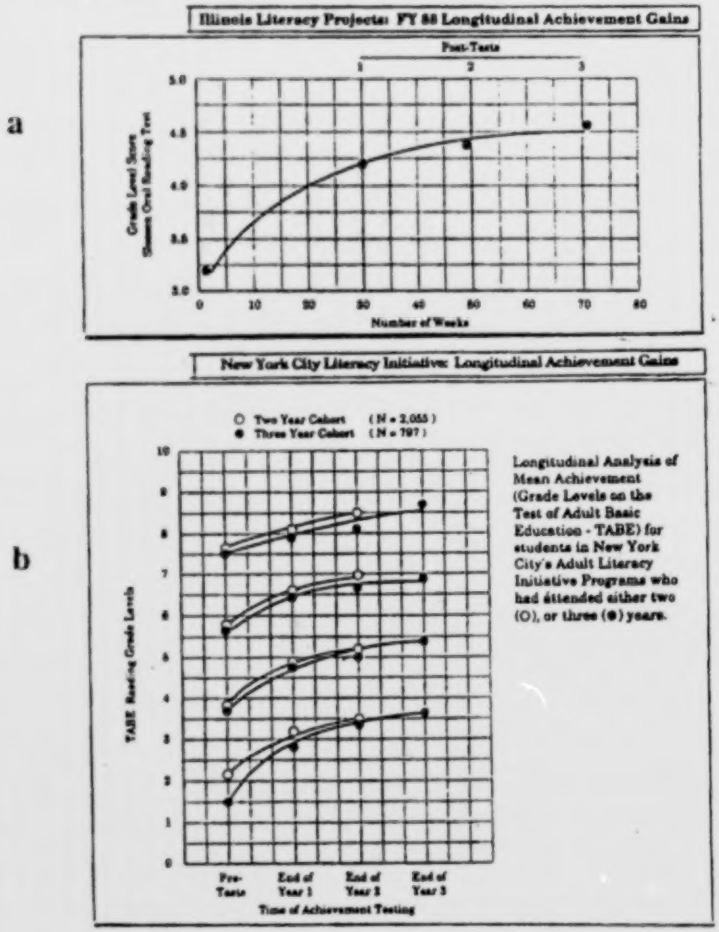
Figure 3.2a,b presents two rare sets of data from programs in which learners were repeatedly assessed over time.[16pp.151-152] Figure 3.2a reports data for 765 adult students in Illinois who were assessed as part of the Illinois Literacy Project . The learners were from 23 different programs that used Literacy Volunteers of America ("whole langauge"), Laubach Literacy ("decoding"), or "eclectic" approaches to literacy instruction. The students were continuing in literacy programs and were tested repeatedly using the same form of the Slosson Oral Reading Test, a measure of word recognition for the most part. So some practice effects are possible. As 3.2a shows, most improvement was made between the pre-test and the first post-test. Overall gain in 70 weeks from the pre-test to the last post-test was about 1.4 years.

Figure 3.3b presents longitudinal data from the Literacy Assistance Center in New York city for adult literacy learners who were enrolled for either two or three years.

Learners were assessed using different forms of the Tests of Adult Basic Education (TABE). The figure shows that most improvement occured between the pre-test and the first post-test, a finding similar to that of the longitudinal data for Illinois.The most improvement was made by those students who pre-tested at the 1.5 reading grade level. They gained about 2.0 "years" by the end of the third year.

Both the Illinois and New York city data suggest that, following the first gain from the pre-test to post-test 1, subsequent improvement occurs at a lower rate. Clearly, assuming everything else stays the same, for students in these studies who scored at the lower levels on the pre-tests (below the 4th grade), several years of study would be necessary for them to achieve at the 9th grade level or above to qualify for a high school equivalency.

Figure 3.2a,b. Longitudinal gains in reading in programs in Illinois (a) and New York City (b).



Longitudinal Analysis of Mean Achievement (Grade Levels on the Test of Adult Basic Education - TABE) for students in New York City's Adult Literacy Initiative Programs who had attended either two (O), or three (●) years.

Designing instructional environments that are conducive to sustained and effective learning, and the intergenerational transfer of such learning in family literacy programs in the various contexts identified above, and with the diversity of adult learners being considered, is not a simple matter. In these contexts mostly part-time adult educators are asked to promote learning among some of the most difficult to teach learners in the nation, often under substandard circumstances, and generally underfunded.

References

[1] U. S. Department of Education. (1993, September). *National evaluation of adult education programs. Second interim report. Profiles of client characteristics.* Washington, DC: Divison of Adult Education and Literacy.

[2] McDonald, B. A., Huie, C. J., Sticht, T. G., & Grimes, W. B. (1994, April). *Learning in the action research center (ARC) community: Inquiry, reflection and change in the delivery system for continuing education services for adults in the San Diego Community College District.* San Diego, CA: San Diego Community College District, Continuing Education Division, Action Research Center.

[3] Sticht, T. G. (1982, June). *Basic skills in defense. Professional Paper 3-82, HumRRO-PP-3-82.* Alexandria, VA: Human Resources Research Organization.

[4] Villanueva, T., Lamb, T. A., & Chin, K. B. O., (1991, October). *Fundamental skills training/education programs in the military.* San Antonio, TX: Paper presented at the Annual Meeting of the Military Testing Association.

[5] Newman, A. P., Lewis, W., & Beverstock, C. (1993, September). *Prison literacy: Implications for program and assessment policy.* Pennsylvania, PA: University of Pennsylvania, National Center on Adult Literacy.

[6] Erickson, P. R. (1994, May). *Inmates' progress: an offenders's travels through the justice system,* p. 17. (unpublished work in progress)

[7] U. S. Department of Labor. (1992). *Job Corps in brief: Program year 1991.* Washington, DC: Employment and Training Administration, Job Corps.

[8] Sticht, T. G. (1994, June). *Workplace literacy programs for ten manufacturing companies in the Chicago, Illinois area: A report of process and outcomes.* Des Plaines, IL: The Center: Workplace Education Division.

[9] Bundy, L. F. (in preparation). Empowerment skills for ESL students. In B. A. McDonald, C. J. Huie, & T. G. Sticht (Eds.), *Teachers as researchers in adult English as a second language and literacy learning classrooms.* San Diego, CA: San Diego Community College District, Continuing Education Division, Action Research Center.

[10] Association of Farmworker Opportunity Progams (1991, April). *National directory of farmworker services.* Washington, DC.

[11] Strong, M., D'Amico, R., Clüver, A. F., Sloan, E., Uratsu, C., Weinstock, P. & Rogers, K. (1993, June). *Evaluation of the JTPA Title IV migrant and seasonal farmworker program. Final report.* Washington, DC: U. S. Department of Labor.

[12] Business Council for Effective Literacy. (1993, January). *LVA & Laubach revisited.* New York, NY.

[13] Sticht, T. G., Beeler, M. J., & McDonald, B. A. (1992). *The intergenerational transfer of cognitive skills: Volume I: Programs, policy, and research issues.* Norwood, NJ: ABLEX Publishing Corporation (a).

[14] Sticht, T. G. (1994, October). *Family literacy: A world movement.* El Cajon, CA: Applied Behavioral & Cognitive Sciences, Inc.

[15] Sticht, T. G., Beeler, M. J., & McDonald, B. A. (1992). *The intergenerational transfer of cognitive skills: Volume II: Theory and research in cognitive science.* Norwood, NJ: ABLEX Publishing Corporation (b).

[16] Sticht, T. & Armstrong, W. (1994, February). *Adult Literacy in the United States: A Compendium of Quantitative Data With Interpretive Comments.* Washington, DC: National Institute for Literacy.

[17] Sticht, T. (1975, June). *A Program of Army Functional Job Reading Training: Development, Implementation, and Delivery Systems.* Final Report HumRRO-FR-WD(CA)-75-7. Alexandria, VA: Human Resources Research Organization.

[18] Sticht, T. (1990, January). *Testing and Assessment in Adult Basic Education and English-as-a -Second Language.* Washington, DC: U. S. Department of Education.

[19] St.Pierre, R., et al (1995, January). *National Evaluation of the Even Start Family Literacy Program. Final Report.* Washington, DC: U. S. Department of Education.

[20] Young, M., Fleischman, H., Fitzgerald, N. & Morgan, M. (1995). *National Evaluation of Adult Education Programs. Executive Summary.* Washington, DC: U. S. Department of Education.

Part 2

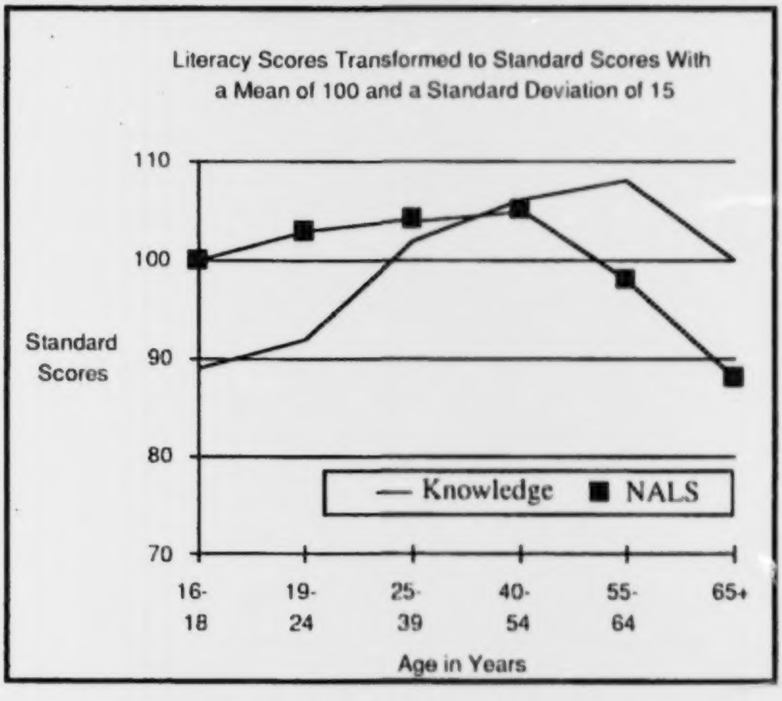
Cognitive Science Foundations For Adult Literacy Education

Declarative Knowledge vs. Complex Task Performance In Assessing Adult Literacy

Research by Ackerman (p.49 of this notebook for full reference) suggests that declarative knowledge is a major contributor to the growth of "verbal intelligence" or literacy during the adult years.

The checklist approach to knowledge assessment developed by Stanovich and associates (p. 74 for references) lends itself readily to the assessment of declarative knowledge. The use of simple items such as names or single vocabulary words, with each yes/no decision made independently of the other does not overload working memory.

This is an especially important factor when assessing the literacy of elderly adults. In the U. S. National Adult Literacy Survey (NALS), data for performance on prose, document, or quantitative scales indicated that, depending on which scale is discussed, performance gradually improved by about .16 to .36 standard deviations as age increased from 16-18 through 40-54 years. However, above age 54, there was a rapid decline of about a half standard deviation for those 55-64 years, and over one standard deviation for those 65 years and older (Kirsch et al., p. 26 for reference).). Since it is well established that working memory becomes increasingly less efficient with advanced age (Sticht, Hofstetter & Hofstetter (p. 74 for reference) these findings strongly suggest that the NALS tasks derive a great deal of their difficulty from the load they place upon working memory. Hence they may seriously underestimate the breadth of materials that older adults can read and comprehend using their knowledge base and the tasks they can perform in working memory given sufficient time to study materials and without the pressure for efficiency that is typical of test-taking situations.



The figure above compares performance of adults on tests of declarative knowledge using the checklist approach and the performance of complex tasks on the NALS. Clearly, growth in declarative knowledge continues beyond age 54 while performance on the NALS drops off rapidly above that age.

BEST COPY AVAILABLE

Chapter 4

Views On Contemporary Cognitive Science

The last quarter century has seen a new interest in human cognition and its development across a variety of scientific disciplines. In "the mind's new science,"[1] anthropologists study the cultural basis of cognition, sociologists study the social distribution of cognitive skills in various groups and institutional settings, psychologists aim to better understand individual cognitive ability, computer scientists work to create "artifical intelligence," and others, such as behavioral geneticists, neuroscientists, linguists, and philosophers have formed subspecialties that study various aspects of human cognition. Taken together, this multidisciplinary enquiry into the nature, workings, and development of the mind is referred to as contemporary cognitive science.

Given the vast number of publications across all these fields of study, it is not possible to present a comprehensive survey of cognitive science. Instead, a summary of major trends will be presented. [2,3] The references to this chapter offer inroads to the literature on cognitive science that the interested reader can pursue for a deeper understanding of this fascinating and socially important field of study.

THE NATURE OF COGNITION

Cognition has at least two main aspects. On the one hand, cognition refers to the mental processes that people use to acquire knowledge, and on the other hand, cognition refers to the knowledge that has been acquired using these mental processes.

Knowledge and cognition. One of the hallmark achievements of cognitive science is the confirmation of the dual nature of cognition: all human intellectual activities, such as thinking, communicating, problem solving, and learning require both processes and knowledge. This is important because it points out the near futility of attempting to improve cognitive ability simply by improving "processes" such as "reading," "writing," "critical thinking," and so forth without recognizing that high levels of ability in performing these processes requires high levels of knowledge on which the processes can operate.[4] It is precisely because content knowledge plays such a large role in cognition that all major tests of "intelligence" assess vocabulary knowledge (frequently in what is called the "verbal" component of intelligence[5]).

Because of the importance of knowledge to cognition and its development, cognitive scientists have made the study of knowledge a central part of their work. The focus of their study generally reflects the focus of their scientific discipline. For instance, cognitive anthropologists have studied how housewives use their knowledge of mathematics in grocery shopping; how literate and illiterate children in Brazil develop knowledge of mathematics involved in selling gum on the streets; and how dairymen invent mental labor saving knowledge for performing mathematics involved in filling milk orders .[6,7,8] These and other studies suggest that the contexts in which people work affect the type of knowledge they develop about mathematics and how well they are able to perform tasks that involve the use of mathematics. They also show that there may be less transfer of mathematical skill from academic settings to applied settings (and vice versa) than one might have thought.

Cognitive psychologists have studied information processing in reading and have found that what a person knows about what they are reading greatly influences their ability to comprehend and learn from texts. In one study, young adults in a remedial reading program required 11th grade "general reading" ability to comprehend with 70 percent accuracy if they lacked much knowledge relevant to what they were reading. On the other hand, those with high amounts of knowledge about what they were reading were able to comprehend with 70 percent accuracy with only 6th grade "general reading" ability.[9]

The "architecture" of human cognition. The influence of computer scientists who strive to develop "artificial intelligence" has focussed more attention on the role of knowledge in human cognition. It has also lead to the concept of an "architecture" of a human cognitive system that is based on the metaphor of the mind as a computer.[10,11] (see figure 5.1 in Chapter 5). In this approach, the mind is considered to have a long term memory that stores knowledge. This long term memory is essentially infinite in capacity.

Additionally, there is a "working" or "short term" memory that contains our thoughts of the moment. The working memory calls on, or "addresses" knowledge in our long term memory, or what is sometimes called our "knowledge" or "data" base, and uses that information in the comprehending, learning, communicating, reasoning and so forth that it is involved in at the moment. But, unlike the long term memory, the capacity of the working memory is severely limited. We cannot keep too many things in mind at one time because of the limited capacity of our working memories. For instance, if we want to dial a telephone number, we may repeat the number over and over again to keep it in working memory long enough to dial it, then we can forget it.

Among the very important findings from studies of the limited capacity of working memory is that the capacity can be expanded if some of the mental processes involved are *automated.* For instance, in reading, it has been found that students who must occupy their limited working memory in decoding print to speech, as in phonics, cannot comprehend well what they are reading. Comprehension requires additional processing "space" in working memory, particularly in regard to addressing knowledge in long term memory and merging it with the new information picked-up from the book. In order to efficiently read and comprehend, it is necessary that the decoding aspect of reading become automatic, that is, performed without conscious attention. This can only be accomplished by hours and hours of practice in reading. This is one of the reasons why "quick-fix" reading programs cannot make much of an improvement in reading comprehension of those low in decoding skill. A second reason, of course, is that to improve reading comprehension much, one must develop a large body of knowledge in long term memory relevant to what is being read. Like skill, the development of large bodies of knowledge takes a long time.

The limitations of working memory are also a major factor in learning and applying mathematics.[12] For instance, in trying to calculate the cost of a meal in a restaurant, the working memory must deal with the locating of information and comprehending the written description of what each item was and what it cost. If working memory space must also be given to recalling how to add, subtract, multiply and divide simple two or three digit numbers, while searching the check, there is much opportunity for mistakes. However, if one has automatized a large number of calculations, such as in learning the multiplication tables up to 12 or so, then calculations can be made while working memory space is left for searching and comprehending the check.

This concept of a human cognitive system with a knowledge base in long term memory and information processing in a limited capacity working memory is one that has emerged over the last quarter century and was not understood in this sense when most of the intervention programs of the War on Poverty were designed and implemented. For this reason the important implications of studies of these system components,their contents, and how they interact with one another and with the information in the external world "outside the head" was not incorporated into the design of these programs. And, for the most part, the knowledge that cognitive scientists have developed about this system has still not influenced education programs (mainstream or intervention) to the degree that it should.

Among the problems encountered are failures to adequately develop new knowledge on the basis of old knowledge, failure to develop knowledge in a systematic, progressive manner, failure to take time to review, consolidate and reorganize old knowledge in the face of new learning, and failure to detect and "repair" faulty prior knowledge that can interfere with new learning (this is an especially important problem in science, where "common sense" understandings are often simply wrong and interfere with the learning of concepts that are not "intuitively" understood).

Lack of understanding of the concept of the working memory and its limited capacity contributes to poor practices in the teaching of subjects such as reading and mathematics. For instance, decoding while reading and calculating in mathematics tasks are both lower order skills. By automatizing such skills through extensive practice, working memory is available for performing higher order processes, such as planning, comprehending, and monitoring ones understanding.[10,13] Frequently, insufficient time is given to practice in reading or to drill in basic arithmetic operations to automate the lower order skill components of reading or mathematics tasks.

Too often, attempts made to teach "higher order, critical thinking skills" or "learning to learn skills" may be ineffective because of insufficient attention to the requirements for content knowledge relevant to what one is supposed to "think critically" about, and to the need to overcome the limitations of working memory by automating component skills of tasks or by other techniques (such as taking notes).[13] The concept of a human cognitive system with its knowledge base and working memory can serve as a useful heuristic for designing better educational programs.

DEVELOPMENT OF COGNITIVE ABILITY

A contemporary understanding of the development of cognitive ability entails a shift in understanding both the nature of and the origins of intelligence. The old view considers intelligence as a one dimensional trait of an individual transmitted genetically as "potential" for learning and adapting to the environment. The new view considers that intelligence is multifaceted and acquired through the automatic operations of the genetically transmitted human cognitive system. This system includes innately given "knowledge" in the form of brain structures and functions that "remember" the physical environment of the parents and produce sensory systems that construct perceptual knowledge (hearing sounds; seeing scenes) through their automatic functioning in the womb and later, after birth, in the physical environment.

From this point of view, cognitive ability, in the form of content in long term memory and information processing in working memory are characteristics of the human infant even before birth. But the contents of the memory system are not known to consciousness. The acquisition of control over mental processes and innately given knowledge develops after birth and results largely from interactions with the physical environment. Among the latter, the most significant interactions for the development of intellectual ability are those that the newborn has with other people, most often the parents, and especially the mother, but also including other caregivers.[5,14,11]

The "nature" versus "nurture" argument. Up until the middle of the 20th century intelligence had been thought of by many as largely biologically predetermined. The "amount" of intelligence an individual had was believed to be present at birth and to remain the same regardless of personal experience or formal training.[15]

Another perspective, however, which argued that intelligence is due to experience and is malleable, had been proposed as early as the 17th century. These opposing points of view constitute a classic argument about intelligence that is known as the "nature vs.nurture" debate. Is intelligence a biologically (nature) determined, innate potential or is intelligence an environmentally (nurture) determined, acquired potential? [15]

In the early decades of the twentieth century, the prevailing view was that it was intelligence that offered people their potential for learning and success. Since intelligence, and hence potential, was inherited there was not much one could do for those of low intelligence. They were best put into protective custody and prevented from reproducing .

However, by the early 1950s the views regarding intelligence had shifted from the "nature" side to the "nurture" side of the argument.[15] Arguments were now put forth that intelligence was not genetically determined, but, rather, was due to the nature of the person's experience.[16] It was argued that intelligence was malleable in early childhood, but that it reached about eighty percent of its adult level by age five or so.[17] Hence, the groundwork was in place for the War on Poverty's emphasis on early childhood interventions to improve the intelligence of children from improvished environments.

During this time, intelligence was still considered as primarily a unitary trait that a person acquired just so much of through experience. The operational measure of intelligence was the "Intelligence Quotient - IQ ." A single number that ranked the person's intelligence in relation to a norming group at each age level.

The developmental theory of Jean Piaget. A developmental model that tempered the strict environmentalist view of learning also became influential during the early 1950s and continues in influence today. Jean Piaget's theory is significant in at least two respects. First, it bridges both the "nature" and "nurture" sides of the intelligence debate and argues that biologically given intellectual structures unfold, much as embryological structures unfold, when thrust into a nurturing environment. Second, he proposes four mechanisms of cognitive development (maturation, experience, social transmission, and equilibration) through which the environment interacts with internal structures of the individual.

While Piaget's theory provides a conceptualization that allows a greater understanding of the structure and progression of cognition, his work does not address the role of knowledge in producing intellectual ability. Indeed, his theory predicts the same sequence of intellectual development as the person matures and experiences the world regardless of the particular nature of the knowledge domains encountered. Furthermore, it predicts that if a person reaches a given level of intellectual development , he or she is at that level in all domains of knowledge. But this is a prediction that has been disproven several times.[14]

Piaget's theory does not extend into adulthood. As in the case of conceptions of intelligence undergirding the early childhood programs of the War on Poverty, Piaget's conceptions of the development of cognition stress the malleabilty of intellect during childhood, not throughout the lifespan. Nor does Piaget's theory of intellectual development directly address the intergenerational transfer of cognitive skills. In his theory, the individual is the focus and the role of social influence is merely to facilitate the automatic unfolding of biological, cognitive structures. However, his work did underscore the potential that was available to all children with the proper life events to bring it about.[14]

In the late 1950s and early 1960s, this new understanding of cognitive ability based on the influence of environment plus the developmental theory of Piaget provided hope for a better future for all, and offered an acceptable explanation for the correlation between minority group status, poor school achievement, and poverty. The presumed connection between minority group status and poverty was poor environment. Pursuing this theoretical perspective, the government implemented a number of social programs designed to improve the early environments of "disadvantaged" youth. The results were not all that it was hoped they would be. It has been suggested that part of the reason for these results was the understanding of human intelligence in place at the time.[14,11]

A NEW PERSPECTIVE: THE SOCIAL BASIS OF MIND

Most discussions of the "nature and nurture" of human intelligence or cognitive abilities have focused on the innate capacities transmitted to the individual at birth as establishing the person's "potential" for cognitive development in interaction with the environment. This "interactionist" view of intelligence starts with the individual and attempts to determine the important factors that influence the individual's cognitive development.

A sociocultural view of cognitive development. A newer view of cognitive ability does not start with the biology of the individual or with the environment, but, rather, with the culture and society into which the individual is born. While genetics provides the anatomical structures and physiological functions that make the individual capable of cognition, and the physical environment (nutrition; gravity; light; structures such as trees, etc.) makes possible existence as a functioning biological organism, society and culture provide the most important resources for human cognitive development. These resources include symbols and symbol systems, such as the natural language and conceptual (in contrast to perceptual) knowledge, which consitute the primary means for the transmission of cognitive abilities. Very importantly, social groups direct the person's cognitive development through the value placed on the learning of certain skills, thereby providing the all important motivation for engaging in learning and behavior that lead to an individual's cognitive development beyond that resulting from untutored experience in the world.

In this view, the society and culture provide the context into which the individual begins his or her experience. The raw materials mentioned before are all present without the intervention of society, of course - the planets and trees and colors and gravity - but they would make no sense to the individual without the teaching of others. Societies possess language and communication and the other tools for comprehending, explaining, thinking about, and elaborating upon all of human experience. So, while previous views of cognitive ability suggest that there is some sort of innate potential that exists within an individual, another view would suggest that there is potential within the sociocultural context for development of the individual. The individual is born into a society of potential intellect. Knowledge will develop largely based on the evolution of intellect within the society and culture.

The social nature of mind. The sociocultural view of cognitive ability was advanced in the early 1900s and has recently regained interest among cognitive scientists as social constructivism and contextualism has emerged.[14,6,18,19] The sociocultural theory of cognition attempts to explain the cognitive development of the species and social groups (cultures) as well as individual development. In this theory, all higher psychological functions exist first and foremost in the interaction between individuals. Initially, the child has no way of understanding or communicating his or her experiences. It is through the teaching of parents and other members of the community that children come to understand the world they inhabit. Of course, the knowledge and values that caregivers have to pass on to their offspring reflect their particular social and cultural groups. Hence, cognitive skills individuals develop incorporate the knowledge and ways of thinking of their culture.

Language and cognition. The cognitive tools of the culture form a significant share of the knowledge transmitted as cognitive ability. These tools include, among other things, language and organized bodies of knowledge. Of these, language is the cornerstone of society. By learning the language, the child is introduced to the shared knowledge of the community. Parents, no matter what their socioeconomic or educational level, interpret the world for their children. Early learning takes place through the internalization of this interpretation of the world. Later, after the internalization of the ideas of the parents and society, children begin to use the language internally to guide their thinking and to function independently. Language, including the written language in literate groups, is the unifying tool for the culture. As language develops, so are social norms, cultural beliefs and values. [20]

Motivation and the value of learning. It has been argued that cognitive ability alone cannot account for achievement.[21] In addition to language and other cognitive tools transmitted to new members of society, there are important motivational conditions transmitted as well. These motivational states help to determine the level of achievement by community members. Cognitive sociologists have referred to the motivational aspect of social communities as social capital.[22] People learn information that corresponds to their view of the world - and they learn skills that will be meaningful to them. Children who are born into poverty whose parents' lives and communities are characterized by unemployment may not see the value of formal education, much less the learning of calculus.They may not think that it makes any difference to them. As adults, they may pass on similar beliefs and attitudes to their offspring.[22,23,24]

In addition to messages about the value of learning, people also receive messages that help them determine whether or not they are capable of learning. They learn well, or not, depending on their view of their own ability to learn. An example of this motivational condition is the way the culture responds to failure and errors. There are culturally transmitted attitudes about the probability of learning successfully after one has initially failed to learn. These attitudes can greatly affect future learning.[21]

The individual within the group. From this perspective, the importance of the social and cultural niche on the development of cognitive ability in the individual can be seen. The broad features of the society, such as the technologies it possesses and the sophistication of the language, and the values placed on certain abilities such as mathematics can be predicted to largely determine the potential of the individual.These broad features will be interpreted through the local community, and will influence the extent or direction of development. Therefore, noncognitive aspects of the environment such as motivation are important as well and strongly influence the degree to which individuals will achieve.

But it is not the social environment alone that determines development. The individual and the way in which all of these experiences are interpreted, will make the rest of the difference. Cognition occurs within the context of a "mental model" that is built by the individual in response to experience in the world. This mental context both results from and results in the individual's unique cognitive development.

In spite of sociocultural similarities for a group of individuals living together, there are often huge differences in the ways in which these individuals develop. The culture of the individual, the community, the neighborhood, social organizations and the family will all influence the experience of the world by the individual, but the experience will be unique. As pervasive as is the influence of the culture, it is just as true that each individual is unique. One often encounters children born and raised in the same family environment who achieve at much different levels. One of the explanations for this phenomenon is that no one ever experiences the world exactly the same as anyone else. As one behavioral geneticist has noted, there is frequently as much variability in intelligence within families as there is across the entire population.[25]

There are aspects of the culture that are shared by individuals and those that are not shared by individuals. These unshared aspects of the environment are of great importance for individual differences. As noted, the variance in cognitive ability within families may be as great as that across families not sharing the same environment. By concentrating on mean differences between large groups of people this important aspect of individual differences has been overlooked. To understand an individual's cognitive development, the context of the individual should be studied, including both the environmental (physical and social) context external to the person, and the internal context of the person's "mental model." While this greatly complicates the study of human cognition and its development, it is the only way to fully understand the growth of individual intellect.

NEW DIRECTIONS FOR FUTURE PROGRAMS

Several aspects of contemporary concepts of cognition and its development are different from earlier concepts and offer new directions for education and training programs for youth and adults. First, the social basis of intellectual development focusses on the role of social interactions in the intergenerational transfer of cognitive ability. It emphasizes the need to develop the *social captial* [22] needed to provide cutural knowledge and the values needed to sustain the learning of such knowledge.

Second, there is a new appreciation of the role of content knowledge in cognitive ability. It is vast bodies of knowledge that appear to give people the edge on learning more and more efficiently. From this perspective, earlier attempts to improve "intelligence" as a unidimensional "trait", or even achievement in "reading" as a pure processing skill, independent of the content being processed, appear inappropriate. The development of *human capital* requires greater attention to the role of content knowledge in cognition.

The concept of a human cognitive system implies a more analytic approach to cognitive development than the unitary trait conception of intelligence, one that addresses information processing within the cognitive system. Detailed cognitive task analyses reveal the interweaving of contexts, tasks, knowledge, and information processing by a person or groups of people involved in socially organized activities. The complexity of the interactions of these aspects of cognitive task performance suggests that much more attention should be given to teaching within the *functional contexts* in which we expect people to become active. This not only facilitates learning, it also facilitates transfer of learning to operational settings.

Finally, the new understanding of the role of specific knowledge, functional contexts, and social interactions in cognition suggests that cognitive development can be considered as a lifelong activity.[26] New knowledge acquired in workplaces, during vacation travel, and so forth all contribute to the cognitive ability of the person. Because such experiences tend to be more varied than the school-based experiences of children, adults are likely to develop more varied cognitive ability. This makes it difficult to make uniform, universally suitable assessments of cognitive development in adulthood. This is a challenge for those who wish to practice the educational arts with youth and adults. This is the topic of the next chapter.

References

[1] Gardner, H. (1985). *The Mind's New Science: A History of the Cognitive Revolution*. New York: Basic Books.

[2] Sticht, T,. Beeler, M., & McDonald, B. (1992a). *The Intergenerational Transfer of Cognitive Skills: Volume I: Programs , Policy, and Research Issues*. Norwood, NJ: ABLEX.

[3] Sticht, T,. Beeler, M., & McDonald, B. (1992b). *The Intergenerational Transfer of Cognitive Skills: Volume II: Theory and Research in Cognitive Science*. Norwood, NJ: ABLEX.

[4] Hirsch, E. Jr. (1987). *Cultural Literacy*. Boston: Houghton Mifflin.

[5] Carroll, J. (1982). The measurement of intelligence. In: *R. Sternberg (Ed.) Handbook of Human Intelligence*. New York: Cambridge University Press.

[6] Rogoff, B. & Lave, J. (Eds.). (1984). *Everyday Cognition: Its Development in Social Context*. Cambridge, MA: Harvard University Press.

[7] Sternberg, R. & Wagner, R. (Eds.). (1986). *Practical Intelligence*. Cambridge, MA: Harvard University Press.

[8] Lave, J. (1988). *Cognition in Practice: Mind, Mathematics and Culture in Everyday Life*. New York: Cambridge University Press.

[9] Sticht, T. et al. (1986, February). *Teachers, Books, Computers, and Peers: Integrated Communications Technologies for Adult Literacy Development*. Monterey, CA: U. S. Naval Postgraduate School.

[10] Chipman, S. (1992). The higher order skills: what they are and how they might be transmitted. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992b). *The Intergenerational Transfer of Cognitive Skills: Volume II: Theory and Research in Cognitive Science*. Norwood, NJ: ABLEX, pp. 128-158.

[11] Wagner, R. (1992). Conceptions of intelligence. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992b). *The Intergenerational Transfer of Cognitive Skills: Volume II: Theory and Research in Cognitive Science*. Norwood, NJ: ABLEX, pp. 172-192.

[12] Kirsch, I. & Jungeblut, A. (1986). *Literacy: Profiles of America's Young Adults*. Princeton, NJ: National Assessment of Educational Progress, Educational Testing Service.

[13] Nickerson, R. (1992). The intergenerational transmission of thinking skills. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992b). *The Intergenerational Transfer of*

Cognitive Skills: Volume II: Theory and Research in Cognitive Science. Norwood, NJ: ABLEX, pp. 159-171.

[14] Gavelek, J. (1992). Developmental perspectives on the intergenerational transfer of cognitive skills. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992b). *The Intergenerational Transfer of Cognitive Skills: Volume II: Theory and Research in Cognitive Science*. Norwood, NJ: ABLEX, pp. 14-40.

[15] Spitz, H. (1986). *The Raising of Intelligence: A Selected History of Attempts to Raise Retarded Intelligence*. Hillsdale, NJ: Lawrence Erlbaum Associates.

[16] Hunt, J. (1961). *Intelligence and Experience*. New York: Ronald Press.

[17] Bloom, B. (1964). *Stability and Change in Human Characteristics*. New York: Wiley.

[18] Serpell, R. & Cole, M. (1992). Conceptual and theoretical issues in the ITCS. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992a). *The Intergenerational Transfer of Cognitive Skills: Volume I: Programs, Policy, and Research Issues*. Norwood, NJ: ABLEX, pp. 172-175.

[19] Cole, M. & The Laboratory of Comparative Human Cognition. (1988, April). *A Cultural Theory of Learning and Development: Implications for Educational Research and Practice*. Paper presented at the Annual Meeting of the Educational Research Association, New Orleans.

[20] Reder, S. (1992). Getting the message across: cultural factors in the intergenerational transfer of cognitive skills. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992b). *The Intergenerational Transfer of Cognitive Skills: Volume II: Theory and Research in Cognitive Science*. Norwood, NJ: ABLEX, pp. 202-228.

[21] Scott-Jones, D. (1992) Family and community interventions affecting the development of cognitive skills in children. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992a). *The Intergenerational Transfer of Cognitive Skills: Volume I: Programs, Policy, and Research Issues*. Norwood, NJ: ABLEX, pp. 84-108.

[22] Coleman, J. & Hoffer, T. (1987). *Public and Private High Schools*. New York: Basic Books.

[23] Ginsburg, H., Bempechat, J. & Chung, Y. (1992). Parent influences on children's mathematics. In: T. Sticht, M. Beeler & B. McDonald (Eds.) (1992b). *The Intergenerational Transfer of Cognitive Skills: Volume II: Theory and Research in Cognitive Science*. Norwood, NJ: ABLEX, pp. 91-121.

[24] Schorr, L. (1988). *Within Our Reach: Breaking the Cycle of Disadvantage*. New York: Doubleday.

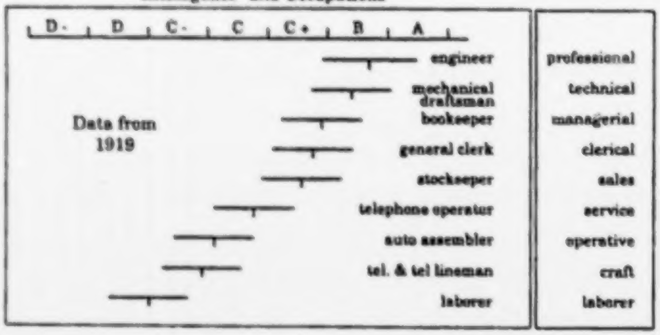
[25] Plomin, R. (1988). The nature and nurture of cognitive ability. In: R. Sternberg (Ed.) *Advances in the Psychology of Intelligence. Vol. 4*. Hillsdale, NJ: Lawrence Erlbaum Associates.

[26] Ackerman, P. (1996). A theory of adult intellectual development: process, personality, interests, and knowledge. *Intelligence, 22*,227-257.

Intelligence, Literacy and Occupations

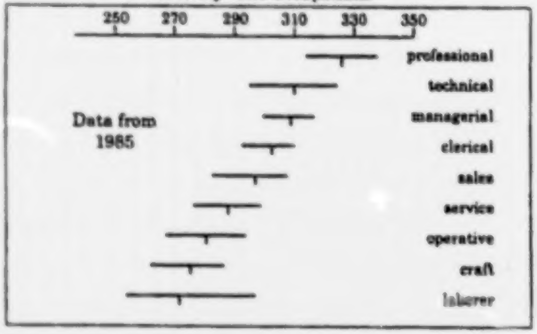
This figure shows that whether one calls adult cognitive skills "intelligence," as in 1919 during World War I, or "literacy," as in 1986 when the profiles of young adult literacy were published, the distributions of cognitive skills in different occupational categories remains the same. The least skilled are found more often in the lower-status, lower paying occupations, which typically demand less education, while the more highly skilled are found in the higher-status, better paying, more educationally demanding occupations. Interestingly, during World War I, over 30% of laborers had their "intelligence" assessed using the Army Beta test for illiterates or non-English speakers. The 1985 young adult literacy survey used a literacy test for all those surveyed (non-English speaking were excluded). The fact that a literacy-based test could be given to almost all young adults, including laborers, in 1985 reflects the fact that considerable gains have been made in rendering the population literate in the last three-quarters of a century. Despite this, the least skilled still occupy the lower rungs of the occupational ladder.

"Intelligence" and Occupations



Source: Yerkes, R. M. (Ed.)(1921). Psychological examining in the United States Army. Washington, DC: Memoirs of the National Academy of Sciences. (pp. 827-829).

"Literacy" and Occupations



Source: Barton, P., and Kirsch, I. (1990, July). Workplace competencies: The need to improve literacy and employment readiness. Washington, DC: U. S. Government Printing Office. Document scale (table 1, p.14).

BEST COPY AVAILABLE

Chapter 5

Introduction to Functional Context Education

In a recent issue of the Harvard Educational Review, an international group of educators called The New London Group put forth a "manifesto" for broadening the concept of literacy into the concept of "multiliteracies." They argued that in addition to the traditional view of literacy as reading and writing, we should consider general symbol use and representational media such as television, computer multimedia, graphic design, drawing, gesture, performance and so forth as forms of literacy. In their discussion they call for, among other things, the use of a pedagogy of functional context education called "situated practice," which is based upon the belief that "...human knowledge, when it is applicable to practice, is primarily situated in sociocultural settings and heavily contextualized in specific knowledge domains and practices." [1]p. 84

Earlier, in research to identify the skills needed and to set standards for successful transition from school into the world of work in the United States, the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS) also addressed the need for "contextualized" instruction in the schools:

> SCANS believes that teachers and schools must begin early to help students see the relationships between what they study and its applications in real-world context...We know from the findings of cognitive science that the most effective way of teaching intellectual skills is "in context," placing learning objectives within real environments rather than insisting that students first learn in the abstract what they will then be expected to apply.[2]
> (pp. 23-24)

As noted by both The New London Group and the SCANS, research in contemporary cognitive science provides an empirical base for *functional context education*, an approach to education in which the teaching of basic language, intellectual and cognitive skills and the subject matter of schools, including education and training progams for out-of-school youth and adults, are integrated into the functional contexts that engage people in the world outside the schoolroom, including the world of work. From this perspective, both learning for and in the world of work is best accomplished following functional context principles.

Functional context education is based upon theoretical constructs and research from action research to develop more effective technical and literacy training programs for use in the world of work , from experimental studies of the effects of contextualizing instruction in the schools, and from laboratory and field research aimed at understanding human cognitive development and its use in school and non-school settings.

*Adult Education Programs: Topic-Oriented vs. Performance-Oriented Learning.*The functional context approach to workforce education and lifelong learning aims to ensure that learners are able to apply what they learn in classrooms or learning centers to parenting, citizenship, community and work tasks outside the classroom. Instead of this *performance* orientation, however, many adult basic education programs generally operate under a *topic* or *subject matter* orientation in which the goal is to acquire academic credentials, such as a high school diploma, not to perform well in social roles outside of class. For instance, in high school completion (GED) classes, the goal is to have learners learn enough about the "core" topics or subject matters of English, mathematics, science, history, and geography to pass the GED test. The concern is not with whether the learner understands the subject matters well enough to apply them to the events of daily life.

One of the consequences of the topic-oriented approach to education is that the subject matter is removed from its contexts of use in the world outside the classroom, and this makes it difficult for learners to know how to apply what they have learned in school to the world of work. In the schools, abstract thought takes precedence over action, symbols over actual objects and activities, and generalizable abstractions over contextualized applications.

This decontextualization can lead to a number of problems. First, it creates an artificial separation between the schools where "booklearning" takes place and the rest of society where "real" learning takes place. For small children this can have an effect if their parents hold no value for "booklearning" and are therefore not likely to read to their preschool child and engage in studying and learning activities themselves to set a role model for their children.

Second, it may lead to the teaching of the basic skills of reading and writing before learners fully understand the functional uses of the written language and other graphic devices. This perpetuates the belief that "first we learn to read and then we read to learn." However, content knowledge can be developed by field trips, oral language, drawing pictures, show-and-tell, and carrying out experiments and demonstrations. Then, when learners are taught reading comprehension skills, they will have a richer body of knowledge to draw on for constructing understandings of what they are reading. So, reading comprehension can be improved even before learners learn to read by teaching them important content through other means.

A third effect of the decontextualization of learning is that youth and adults may not be motivated to learn because they cannot see how what they are being asked to learn will be used in the world outside the school. Hence they may not learn much of what the school has to offer. This does not mean that they will not learn quite a bit outside of school. Many students who are poorly motivated in school learning read and learn a lot about things they are interested in. For instance, a young man may be interested in motorcycles and automobiles and spend a lot of time reading magazines about these vehicles. Thus, while his academic work may suffer, he may show considerable aptitude (i.e., knowledge of vehicles) for reading and learning to be an automobile mechanic .

A fourth effect of decontextualization is that learning may take place in such a way that the knowledge gained in school can be used to pass paper-and-pencil tests of recall, but cannot be used in the world outside of school. A great student in the classroom may fail to see how his or her knowledge can be applied in different "real world" settings. This may lead people to talk about the difference between "academic intelligence" versus "practical intelligence".[3]

A fifth effect of decontextualized education is that when learners leave school and enter the world of work, they may inappropriately apply to work the practices they developed in the school. Thus, if they become instructors in a business or industry setting, they may use methods for teaching and learning *topics* in corporate classrooms rather than developing workplace approaches for improving *performance* .

One study found that military writers who wrote manuals that were supposed to tell people how to do jobs actually approached the task as though they were going to exhaustively cover a topic. Rather than asking for job and task analyses so that they could write procedures for accomplishing tasks, these writers asked for bibliographic citations related to the jobs so they could cover the topic. Instead of targeting their manuals for the worker-users, they aimed them at a general reader having a fairly high reading level. Needless to say, a major problem with the manuals reported by users were that they did not tell them how to do their jobs and they were difficult to read and comprehend.[4]

Functional Context Education: Background and Concepts

This section introduces Functional Context Education (FCE), including the theory of cognitive development, learning, and instruction. Regarding literacy, a general thesis is that the idea that literacy is something one "gets" in one program, which is then "applied" in another is misleading. Rather, it is argued that literacy is developed while it is being applied. This means that for the large numbers of students in secondary or out-of-school programs for youth or adults who read between the fifth and ninth grade levels, literacy and content skills education can be integrated. Through this means, the need for special "remedial" literacy programs to get students to "prerequisite" levels of literacy before they are permitted to study the "real thing," are obviated.

Historical Perspective

The theory and development activities discussed herein have their roots in research initiated in the mid-sixties to understand the nature of literacy, the development of literacy by children, youth, and adults, and the uses of literacy in job training, performance, and progression.[5,6] The latter work was, in turn, stimulated by the civil rights crisis of the sixties, with its attendant concerns for overcoming the consequences of discrimination and poverty through the major educational and employment activities that became known, collectively, as the War on Poverty.

In the War on Poverty, the federal government mobilized the nation's educational research scientists to bring forth their arsenals of new methods for educating pre-school, in-school, and out-of-school children, youth, and adults. Programs such as Head Start, Follow Through, the Job Corps, the Adult Education Act, and others sought to bring the best of educational knowledge to bear on overcoming the "culture of poverty" through education, training, and employment.

A second major crisis of the sixties occurred in the midst of the War on Poverty. This was the war in Vietnam. By the mid-sixties, the military services were rapidly expanding their numbers and, in the process, testing the aptitudes of millions of youth. It was found that almost fifteen percent of the youth did not meet mental standards and were being excluded from service.[7]

Because many of the youth whose mental aptitude scores were below standards were minority and impoverished, a program called Project 100,000 was initiated as a means of involving the military in the War on Poverty. The goal was to extend the education, training, and medical benefits of military service to lower aptitude, poor youth, while also meeting the personnel requirements of the Vietnam war.

When Project 100,000 was initiated, it was anticipated by military manpower policymakers that the literacy skills of these youth would not meet the literacy requirements for the jobs that the armed services had for them to be trained for and to perform. For this reason, research projects were initiated to (1) identify the literacy requirements of jobs that large numbers of less literate, lower aptitude personnel might be assigned, (2) identify the literacy skills of the "new standards" personnel and compare them to the requirements of jobs (including job training programs), and (3) develop new literacy programs that would render personnel literate enough to perform needed job tasks. Additional research called for developing new methods of job technical training that would be suitable for personnel across the spectrum of aptitude, with special interest in developing training methods that would work with the less literate, lower aptitude personnel of Project 100,000.

An extensive review of the research on training lower aptitude personnel conducted prior to, during, and after Project 100,000 synthesizes a large body of military research concerned with a functional context approach to technical and literacy training.[6] Spanning almost half a century, the military research on education and training, when integrated with research in contemporary cognitive science provides an empirical base for a *functional context theory* of cognitive development, learning, and instruction. This theory is sketched in broad outline below.

Functional Context Theory

The functional context theory (FCT) of cognitive development, learning, and instruction stands in contrast to theories that maintain that cognitive or intellectual development proceeds in a predetermined manner through a series of stages or phases that are similar to those of embryological growth and are relatively independent of the environmental context in which the person is living. The earlier Piagetian theory, and strong hereditarian theories of intelligence are examples of contrast theories to FCT (see Rogoff[7] for an extended discussion of the limits of "embryological" theories of cognitive growth and the importance of context in cognitive development).

Briefly stated, FCT maintains that the biological make-up of human beings, the environmental contexts in which they function, and the psychological context of their minds determines what will be learned, how it will be learned, and how the learning will be used (transfer). Cognitive development is the change in the cognitive system that results from changes in the anatomy and physiology of the human brain as it grows, develops, and deteriorates in later life, from the processing of information by the brain but manifested in a mental context called the mind and from the processing of information extracted from the environment in which the person lives. There are, therefore, three concepts of "context." Two of these are "inside" the person. One is the biological, physiological context of the body and brain. The second is the mental context of the mind in which the person's psychological life is constructed. The third concept of context refers to the world "outside" the person. This is the physical and social world in which the person lives; the external environment.

The internal environment or context, which is generally referred to as "mind," is both the result of and the cause of cognitive development through experience. In FCT that aspect of mind involved in learning and cognitive development is referred to as the *human cognitive system,* and includes three major components of the cognitive system: the sensory-perceptual-memory subsystems (see Figure 5.1). The memory subsystem is further analyzed into two aspects: the *knowledge base* or long term memory, and the *working* or short term memory. The working memory is where active thinking takes place. Thinking processes lead us to pick-up information from the outside environment and the internal knowledge base and combine these two sources of information to construct our understanding of the world at a particular moment. These cognitive information processing activities are preceded by, accompanied by and followed by psychophysiological processes that provide an emotional context for learning and behaving.

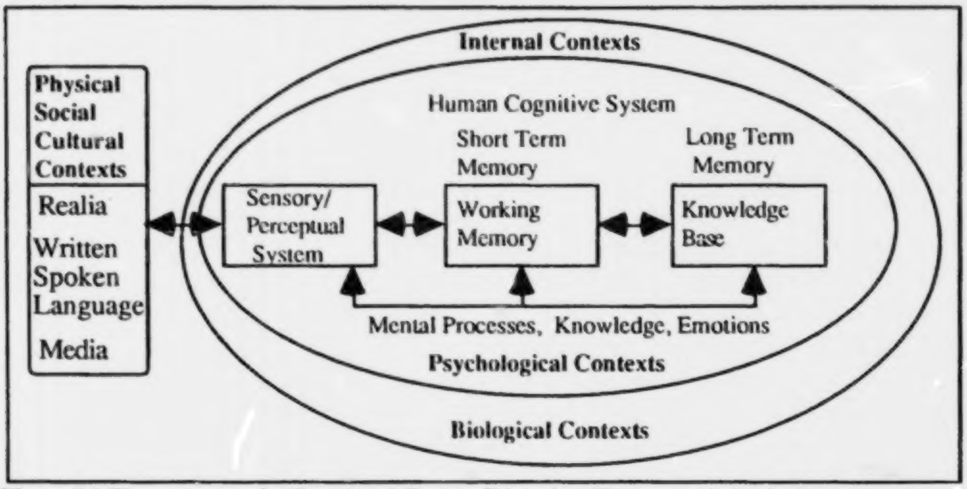


Figure 5.1 Three contexts for Functional Context Education. The external physical, social and cultural context in which people live; the internal, biological context of the organism; and the internal psychological context of the mind of the person.

In learning, the mind's prior knowledge, including the emotional reactions associated with the prior knowledge, directs the acquisition of new information and organizes it into new knowledge. From this point of view, all new learning proceeds from prior learning. The exception being that, in FCT, the assumption is made that the person's first learnings occur prenatally as the automatic outcomes of the operation of the sensory-perceptual-memory system that develops in the womb environment. This means that both prior to and at birth, the newborn infant already possesses prior knowledge, including feelings that we think of as emotions, that form the basis for new learning.

In this way of thinking there is never a "tabula rasa" form of mind. Rather, mind emerges as the zygote develops and the genetically encoded sensory-perceptual-memory components of the human cognitive system come automatically into action.The memory subsystem permits the emergence of mind as the information processing that extracts information from the external world interacts with the information stored in the long term memory. Mind provides a "mental model" of the external world and comes to direct the sensory-perceptual system through processes called "attention" to seek the type of information it (the mind) needs to meet the demands on life in the worldly context in which it finds itself.

A critical feature of the internal mental context is that the memory system permits the person to be psychologically only partially locked into the present. Additionally, the person can live in the past and the future through imagination. This permits the person to "draw on experience" for problem solving in a present context, and to "plan for the future" by undertaking learning experiences in the present. The latter is of particular importance in adult education and training for understanding the motivation of learning.

Unlike children, who tend to do things to please their parents or teachers, adults will usually want to understand the functional utility of investing time and mental energy in learning something. With respect to out-of-school youth and adults then, FCE focuses on (1) on improving motivation by making explicit the relationship between what is being taught and its application in the contexts that the person will be functioning in after the educational program, (2) improving learning by ensuring that instruction relates to the learners prior knowledge in such a way that the learner can function within the learning

BEST COPY AVAILABLE

Before addressing the details of the model, several orienting comments regarding the figure are in order. First the figure is meant to portray a developmental sequence when examined from left to right. The sequence begins with the newborn infant (far left), and goes through stage 4 in which literacy skills are functional. The broad arrowhead on the far right is meant to imply continued development over the lifespan. The development of literacy, language, and knowledge is a lifetime activity.

Examining Figure 5.2 from top to bottom, the top series of boxes is meant to represent the environment in which the person exists. This is the environment "outside the head." This external environment makes available information displays that the person can explore and transform into internal representations of the external information. These internal representations are developed by the processes in the second series of boxes labeled, on the far left, Information Processes in Working Memory. These processes go on "inside the head," and merge information picked up from the external information displays with information picked up from the third series of boxes, labeled on the far left as Long Term Memory. Thus, the processes in the working memory are used to pick up and merge information from outside the body/brain with information in long term memory inside the body/brain to construct an internal representation of the world as currently experienced, including the construction of a meaning represented in symbolic information when this is a major domain of information being extracted from the external world at a given time.

At the top of Figure 5.2, there are references to four "stages." In the present case, the concept of "stage 1" does not refer to automatic and immutable cognitive "unfoldings." Rather, the term refers to what would typically be observed at different times if one studies children growing up in our literate society. For instance, stage 1 refers to the newborn infant who is considered to be innately endowed with the Basic Adaptive Processes involved in sensory/perceptual processes such as hearing and seeing, etc., motor movement, and cognition, including the processes needed to acquire information, mentally manipulate it, store it in memory, form knowledge structures out of it, retrieve and represent the information in various ways. In stage 1, these processes are assumed to work more or less automatically without conscious control, hence an observer would note that the infant seems "captured" by stimuli, rather than selective in observing information in the world.

Stage 2 represents the emergence of conscious control over information pickup and manipulation. This active process of attending to information distinguishes *listening* from hearing, and *looking* from seeing, as information pick-up processes. Listening and looking build internal representations that may be called *images*. Images may also be constructed from data stored in long term memory. These internal imaging processes are frequently assessed in aptitude tests as "spatial perception" or "mechanical comprehension" in which it is necessary to mentally visualize and rotate cog-and-gear systems to determine what effects this movement might have on some other gear.

Stage 2 also introduces the concept of *active* or *working memory*, which is defined by the occurrence of consciously controlled information processing activities. Working memory is a limited memory that can be easily overloaded (e.g., attending to two or three things at once is difficult — if not impossible). Many of the information processing activities the person acquires will be techniques to overcome active memory limits (e.g., repeating information to oneself keeps the information in active working memory until it can be applied). The "stage" aspect of cognitive development shows itself by the ability of the infant to attend to information selectively. This is a cognitive capability which, once developed, is a permanent feature of cognition that distinguishes the stage 2 child from the stage 1 child.

Stage 3 represents the development of language processes out of earlier processes and knowledge stored in long-term memory. In developing oral language, the listening process is used in attending to spoken language to learn the words and grammar of language. Thus, listening *plus languaging*, occurs simultaneously. This joint occurrence is given the special name of *auding*. On the production side, the joint occurrence of uttering (making sounds through the mouth) with the production of word forms from the language pool, and stringing the word forms together to make sentences using the rules of grammar, produces the special process called *speaking*. Auding and speaking comprise the oral language information reception and production skills. Speaking is used to represent information that the person has in his or her mind "outside the head" and in the acoustic medium, while auding is used to pick-up and transform speech information displays into knowledge in the mind of the listener. To an observer, the stage 3 child can respond to and produce oral language, at least to some minimal degree. Again, as with conscious attending, once oral language has begun to emerge, the cognitive system is permanently modified (barring physiological trauma of some sort), and the person is no longer capable of exclusively prelinguistic modes of thought.

In transitioning to stage 4, the information processing skills of looking and marking are used to learn a representational system which, in many respects, represents the spoken language in a different medium- light- and in a more or less permanent graphic display: the written language. Looking at written language and transforming the written language into meaning is called *reading*. Writing is the special use of marking skills to produce graphic language (and other symbols and symbol systems).

In the typical case, children develop a fair amount of competence in oral language before they are exposed to formal instruction in reading in elementary grades (though informal learning of literacy may begin in the home and community in literate cultures). In literacy instruction, written language skills build upon the earlier developed oral language skills and add to the person's knowledge base special knowledge about how to represent and comprehend information in the graphic medium that was previously represented and comprehended by the person only in the oral langauge. Later, learning new vocabulary and conventions of language through reading and writing reflects back on oral language development and enlarges the person's oral language abilities. The large arrow at the far right in Figure 5.2 is meant to represent the notion that the development of oral and written langauge ability may continue indefinitely as the person studies and developes new knowledge domains.

A major component of Figure 5.2 is the person's long term memory or "knowledge base." The long term memory contains all the knowledge developed by the person in interaction with the environment. Much of the knowledge acquired by the person will not be understood in consciousness (for example, the rules of grammar). Rather, it will be unconsciously used to accomplish tasks such as developing language competency and comprehending the events of the world. In addition to the general world knowledge and processes that are in the mind, though not accessible to conscious understanding without considerable analysis, the memory also contains the language knowledge (words and grammar) that can be used to represent information that arises from experience in the world (e.g., bodies of knowledge about machines, parts of the body, houses, neighborhoods — sometimes called "schema" [10] or "mental models" [11]) and from didactic instruction, as in training programs.

The model holds that the development of the oracy skills of speaking and auding are built upon the prior development of prelinguistic knowledge through information processing activities. It is important that it be understood that this early, prelinguistic cognitive content, or knowledge, will form the foundation for the acquisition of new knowledge over the person's lifetime, including that knowledge known as "literacy."

Much of this knowledge will remain personal, and will not be explicitly represented in language for communication to others. Nonetheless, such personal, tacit knowledge, which includes perceptual learnings and general knowledge of "how the world works," will be absolutely necessary for learning to comprehend the spoken, and later the written, language. This reflects the fact that language is selective in the features and concepts chosen to be represented. We may think of language as producing a verbal *figure,* which can be comprehended only in terms of its relationship to a nonlinguistic conceptual *ground* of "world knowledge." A simple illustration of the role or "world knowledge" in literacy training is seen in the recommendation to give students experience with objects and events in the world through field trips, demonstrations, movies, etc., before they read about them. This approach provides an experiential base or a "world knowledge" which will permit a deeper comprehension of the words and concepts the students read, and greater "access" to prior knowledge via perceptual learning .[9]

A final aspect of the model is that it recognizes that, on the one hand, the literacy skills of reading and writing utilize the same knowledge base that is used in auding and speaking, plus the special decoding and encoding skills of reading and writing. On the other hand, the very nature of the written language display — characterized by being more or less permanent, being arrayed in space, and utilizing the features of light (color, contrast) — makes possible the development of skills and knowledge entirely different from those involved in oral language.

The model incorporates the role of prelinguistic looking and marking abilities as contributors to later utilization of the visual display of written language in conjunction with lines, white space, and color to develop graphic tools such as matrices, flow charts, color coded graphs, and the like. These tools combine with written language and non-language graphic symbols, such as arrowheads and geometric figures, to produce analytical products beyond those obtainable through the fleeting, temporal, oral language.

A point to be emphasized is the fact that much of the acquisition of literacy is not simply learning to read; that is, it is not just learning a graphic language system that can be substituted for the oral language system. Rather, a large part of learning to be literate, and perhaps the most important part for acquiring higher levels of literacy, is learning how to perform the many tasks made possible by the unique characteristics of printed displays — their permanence, spatiality, and use of light, and using that knowledge to develop large amounts of new knowledge.

The foregoing, and Figure 5.2 briefly summarize the structure of the developmental model of literacy and emphasize:

> •An architecture for a *human cognitive system* that contains a long term memory (knowledge base) and a working memory. The mind draws upon certain procedural knowledge, including language, that is in the long term memory and uses that procedural knowledge for processing information taken both from the long term memory and from the external world. The latter serves as a sort of "external memory" that displays information to be picked up by the sensory systems and internal processing skills and merged with prior knowledge in the process generally called "learning."[13]
>
> •The development of additional knowledge, including that knowledge known as literacy, as extensions to or transformations of earlier knowledge. The developmental model emphasizes the development of oral language from earlier, prelinguistic

knowledge, and literacy as an amalgam of prelinguistic (stages 1 and 2) and linguistic (stage 3) knowledge. Literacy includes the procedural knowledge (processes) used in guiding information pick-up and processing by the visual, auditory, and other perceptual systems, and declarative knowledge generally representable in oral and graphic symbol systems (this includes content knowledge such as mathematics, geography, etc. when learned).

Learning as Information Processing

In addition to a model of cognitive development, illustrated with regard to literacy, above, FCT includes a conception of learning as the outcome of information processing with an emphasis upon internal mental processes involved in learning. It views the person as an active, adaptive organism busily ordering and arranging an internalized representation of life space. According to this view, learning is the resultant of an active, *constructive* process on the part of the learner working with information from the internal or external environments. This differs from a strict behavioristic conception in which learning is the result of some fixed, automatic process of association among stimuli, responses, and their consequences.

The information processing approach to learning emphasizes internal strategies for dealing with information, such as the use of imagery or mnemonic (contextualizing) devices to aid in learning a list of words. Thus, the information processing position would lead us to seek different internal processing strategies even though certain stimulus-response sequences may be the same. For instance, interest would focus not only on whether or not a problem is solved, but also upon how it was solved. It is thus analytic, stressing the detailed analysis of tasks in regard to the knowledge and mental operations involved "inside the head" between the occurrence of a stimulus and a subsequent response (i.e., "cognitive task analysis").

A most important aspect of the information processing approach to learning is the emphasis upon the *active, construing* nature of the person as he or she draws upon prior knowledge to function in the current learning context. This suggests that instructional programs should offer an environment for and a stimulus to active information seeking, mental representation and re-representation to bring a larger share of prior knowledge to bear on the learning task, and external communication to check, confirm and further develop learning.

Automaticity and the Importance of Drill and Practice

Engagement in interesting, meaningful, problem posing and solving activities can lead to learning, comprehension, understanding and knowledge development. However, there are some aspects of cognitive development that require drill and practice.

For instance, in learning to read and write, there must be sufficient practice to ensure that word recognition (reading) and production (writing) become automatic. That is, recognition and production processes must move from being actively thought about in working memory to becoming processes executed without occupying the limited capacity of working memory, that is, they must be unconsciously performed. That is what has traditionally led to these recognition and production processes being referred to as the "mechanics" of literacy. They must be developed through extensive practice to the point where their performance is "mechanical" or without conscious thought.

Similarly, in learning arithmetic, drills in mentally adding, subtracting, multiplying and dividing of numbers up to ten or twelve can help transform these processes from those that require computational space in working memory to activities in which the sums or products are retrieved directly from long term memory where the drill has caused them to be stored as a part of the declarative knowledge base. In general, in learning skills that involve the transformation of conscious processes into unconscious processes, drill and/or practice of some sort is necessary.

Summary

The theoretical framework for functional context education includes the following concepts from the cognitive sciences:

- *The learner has a "human cognitive system"* with an internal knowledge base "inside the head" and access to an external knowledge base in the world "outside the head." The learner has a working, or short term memory in which processing skills such as language are used to move information in and out of both the internal and external knowledge bases.

- *Learning as information processing* with an emphasis on the internal mental processes involved in learning and the conception of learning as an outcome of these processes.

- *A developmental perspective of literacy* emphasizing the development of oral language from earlier prelinguistic knowledge and literacy as the amalgam of prelinguistic, linguistic and graphic symbolic knowledge.

- *The importance of context* in learning new information and in transferring information already learned to new and different problems and situations.

The application of this theoretical framework to the instructional development process suggests creating courses that facilitate learning on entry into the course, learning throughout the course, and transfer into the contexts for which the learning is meant to apply. To accomplish these objectives, courses should be developed that:

- Explain what the students are to learn and why in such a way that they can always understand both the immediate and long term usefulness of the course content (facilitates entry into the course; motivates learning).

- Consider the old knowledge that students bring with them to the course, and build new knowledge on the basis of this old knowledge (facilitates entry learning)

- Sequence each new lesson so that it builds on prior knowledge gained in the previous lessons (facilitates in-course learning).

- Integrate instruction in reading, writing, arithmetic, and problem solving into academic or technical training programs as the content of the course poses requirements for information processing using these skills that many potential students may not possess; avoid decontextualized basic skills "remedial" programs (facilitates in-course learning; motivates basic skills learning; reduces instruction time; develops "learning to learn" ability transferable beyond the course).

- Derive objectives from careful analysis of the explicit and tacit knowledge and skill needed in the academic, technical training, or employment context for which the learner is preparing (facilitates transfer).

- Use, to the extent possible, learning contexts, tasks, materials, and procedures taken from the future situation in which the learner will be functioning (facilitates transfer).

Given that the instructional principles are rather general, the best method for conveying to others how they might be used to develop instruction would seem to be through examples. Chapters 7, 8 , 9 and 10 discuss four examples of functional context education programs. But first chapter 6 discusses FCE and literacy instruction for out-of-school youth and adults.

References

[1]The New London Group (1996). A Pedagogy of Multiliteracies: Designing Social Futures. *Harvard Educational Review, 66*, 60-92.

[2]Secretary's Commission on the Achievement of Necessary Skills (SCANS). (1991, June). *What Work Requires of Schools: A SCANS Report for AMERICA 2000*. Washington, DC: U. S. Department of Labor.

[3]Sternberg, R. & Wagner, R. (Eds.). (1986). *Practical Intelligence*. Cambridge, MA: Harvard University Press.

[4]Kern, R., Sticht, T., Zapf, D., & Hauke, R. (1975). *Guidebook for the Development of Army Training Literature*. Alexandria, VA: U. S. Army Research Institute for the Behavioral & Social Sciences.

[5]Sticht, T. (1975). *Reading for Working: A Functional Literacy Anthology*. Alexandria, VA: Human Resources Research Orgnization.

[6]Sticht, T., Beck, L., Hauke, R., Kleiman, G. & James, J. (1974). *Auding and Reading: A Developmental Model*. Alexandria, VA: Human Resources Research Organization.

[7]Sticht, T., Armstrong, W., Hickey, D. & Caylor, J. (1987). *Cast-off Youth: Policy and Training methods from the military experience*. NY: Praeger.

[8]Rogoff, B. (1982). Integrating context and cognitive development. In: M. Lamb & A. Brown (Eds.). *Advances in Developmental Psychology. Volume 2*. Hillsdale, NJ: Lawrence Earlbaum.

[9]Brown, A. & Campione, J. (1986). Psychological theory and the study of learning disabilities. *American Psychologist, 41*, 1059-1068.

[10]Bransford, J., Sherwood, R., Vige, N. & Rieser, J. (1986). Teaching thinking and problem solving. *American Psychologist, 41*, 1078-1089.

[11]Rumelhart, D. (1980). Schemata. In: B. Bruce & W. Brewer (Eds.).*Theoretical issues in Reading Comprehension*. Hillsdale, NJ: Lawrence Earlbaum.

[12] Rouse, W. & Morris, N. (1985). *On looking into the black box: prospects and limits in the search for mental models*. (Report No. 85-2). Atlanta, GA: Georgia Institute of Technology, Center for Man-Machine Systems Research.

[13]Healy, A. F., & McNamara, D. S. (1996). Verbal learning and memory: Does the modal model still work? Spence, J., Darley, J. & Foss, D. (eds.) *Annual review of psychology, Vol. 47*, Palo Alto, CA: Annual Reviews, Inc., pp. 143-172.

Chapter 6

Functional Context Education and Literacy Instruction

The teaching of literacy to adults has many controversies regarding objectives and methods. This chapter focusses on what teachers can teach and learners can learn if literacy is considered a part of the use of graphics technology. As noted in Chapter 5 in discussing the developmental model of literacy, though both literacy and oral language share a largely common grammar (lexicon and syntax), the graphic medium has features that differ from speech. These features include permanence, spatiality, and light.

The literate makes use of these features by drawing upon the human cognitive system with its knowledge base and information processing abilities. The permanence of graphic displays makes possible the storage of knowledge "outside the head" and makes it necessary for other literates to learn reading as a means of retrieving the stored information. Similarly, the fact that the graphics medium uses space and light makes possible the design of a wide variety of displays that permit literates to perform a number of cognitive and communication tasks. The use of this framework in developing functional context reading programs for mid-level literate adults is described later.

Debates About "Approaches"

Like the teaching of reading to children, the teaching of reading to adults is beginning to have many controversies. As educators who have traditionally focussed upon literacy in childhood have entered the area of adulthood literacy development, they have brought the debates about the "whole language" approach versus the "word recognition", "decoding", or "phonics" approach to the field of adult reading .[1,24]

Additionally, there are debates about the purposes of teaching adults to read, generally framed in the larger context of teaching literacy. Some argue for literacy for "empowerment," "giving voice," or stimulating "critical awareness" while eschewing reading (literacy) instruction that is "technical," that is, aimed at teaching reading "merely" as a cognitive task .[2]

Though there is no doubting the importance of the many issues involved in these debates, our literature review has found that, with the exception of Functional Context Education, no body of empirical evidence exists to argue convincingly that students learn better, go farther in their education, or become more successful citizens in programs operated in line with one or the other point of view.[18] And, indeed, there is often considerable ambiguity about just what the words being used actually mean to different people .[3]

With the exception of the extensive research that has lead to the formulation of Functional Context Education, little by way of empirical evidence has been found to argue for one "method" or "approach" to adult literacy education over another. This is illustrated by the data on pre- and post-tests summarized in Chapter 3 of this notebook.

Given the controversies and the variety of ways of viewing the job of teaching adults to read, and the paucity of empirical studies on "best practices," this chapter presents a more-or-less technical analysis of what learners might learn and what teachers might teach if literacy is viewed as one aspect of the use of graphics technology to develop tools for communicating, developing knowledge, and accomplishing various tasks.[4] The advantage of this approach is that it presents a body of technical knowledge that may be learned within the context of any of the various ideologies or instructional belief systems held by teachers of adults. For instance, whether one subscribes to the "whole language" or "decoding," "meaning-making" or "skills & drills" approaches to literacy instruction, or to "empowerment" or "functional, economic, utility" as aims of instruction, learners who wish to become literates or to improve their literacy must learn to recognize, interpret, and produce graphic symbols and devices such as forms, maps, and textbooks.

An Orientation to Native English Speaking Adult Reading Learners

We consider that native English speaking adults who are learning to read enter into the instructional setting with some considerable past history of learning. They have the capacity to learn and to problem solve in real world settings of more or less complexity. They have a knowledge base that includes the English language, both lexicon and syntax (teaching English as a Second Language-ESL is not being discussed here) and the pragmatics of use of the language. Their lexical/semantic knowledge may be limited in relation to more literate age peers, though most will have been through several years of formal education.

Most adult reading learners in our literate society already possess some knowledge of the functional uses of written language and other graphic devices such as books, forms, bus schedules and so forth. But they may need to develop this understanding in greater breadth and depth. Greater "breadth" means that the more tasks a person can perform in various domains of knowledge involving the use of graphics technology and symbolic systems the more "generally literate" the person is. Greater "depth" means that the person can perform a literacy task or a set of literacy tasks more efficiently and with better quality at one time than at an earlier time.

Most of the adults encountered in adult basic education programs will have much practical knowledge of the world. They will have many beliefs and attitudes about teaching, learning, opportunities in life, success, failure, who gets ahead and who does not, and a general philosophy of what life is all about and how it is to be lived. Most will have some idea that they are in reading instruction to change some aspect of their life - to be a better parent by being able to read to their children and to serve as better role models, improve their chances in life and their self esteem by "finishing their education" and getting a high school equivalency certificate, improving their employability or getting a promotion, administering to their spiritual needs by reading religious materials, or improving their access to entertainment and personal enjoyment- through reading.

Most adult reading learners will have considerable knowledge of the uses of tools for accomplishing various tasks in our technological society. Therefore they possess prior knowledge that can be used to construct an understanding of reading (and writing) as the use of graphics technology for communicating, developing knowledge and accomplishing tasks. This point of view provides the content for reading instruction discussed below.

LITERACY AS TECHNOLOGY

In anthropological terms, *technology* is the body of knowledge a civilization uses to fashion implements, extract or collect materials, or practice various arts and skills[5] (p. 1321). From this point of view, *literacy* may be thought of as technology for producing and comprehending graphic displays as tools (implements) for accomplishing various cognitive and communicational activities.[6,7] In writing, the person "extracts" knowledge from the brain and "collects" (stores) it in graphic displays. Then, through the practice of the skill of reading, the collected knowledge is extracted by the person from the graphic display and reconstructed in the brain.

By considering literacy as competence in working with graphics technology, instructors can help adult learners understand that much of what is encountered in teaching and learning reading results from the fundamental characteristics of graphics displays. These characteristics permit literates to work with the graphics technology in certain ways. Furthermore, the products of the work of literates create new graphics displays (e.g., history timelines; TV schedules; troubleshooting flow diagrams; atlases, etc.). This imposes demands upon new readers who wish to learn to work with these new displays.

Major Features of Graphics Technology

The major features of graphics technology, examples of the types of products that may be produced by those in command of the technology, and examples of the types of demands for information processing that the products of this technology may require include:

1. Permanence. Graphic information displays, such as this page of print, or forms, tables , graphs, and so forth, are more or less *permanent*. Therefore, they can be used to collect or store information, including an extended body of knowledge. The information can be stored over time and retrieved later on, and it can be transported across space.

In reading instruction, the relative permanence of the graphic display permits the teaching of "*reading-to-do*" and "*reading-to-learn*" processes.[8] In reading-to-do, the permanence of the material permits the reader to consult it while performing a task. For instance, in filling-out a parts form in an automotive supply store, the part number can be looked-up, held in working memory just long enough to do the task of completing that part of the form, and it can then be forgotten. Because the parts catalog serves as a graphic "memory" device for storing information, the part number can be looked-up again when needed. There is no need for the clerk to memorize or otherwise learn the numbers of the parts in the store.

In reading-to-learn, much of what is taught as "study skills," or "learning strategies" reflects the property of the permanence of graphic displays and their ability to be studied at length and repeatedly read to extract the information collected in the display(s) and to relate it to prior knowledge. Strategies such as the variants of Robinson's SQ3R - Survey, Question, Read, Recite and Review - , which give suggestions for information processing before reading, during reading, and after reading, were invented because the permanence of graphic displays permits the storage of knowledge and the need, then, for new learners to acquire the knowledge by reading.[9]

The permanence feature of graphic displays permits the storage of information over time or its transportation over space or both. This has the effect of removing the information display from its original setting or context. In turn, this makes it necessary to learn ways of making graphics displays so that they can be used out of context and of ways for comprehending such decontextualized displays. Much of what is taught about "conventionalized" devices such as topic sentences, greetings, salutations, narratives, exposition and so forth results from the capacity for decontextualization that permanent graphics displays exhibit, and the need, then, to have "recontextualizing" devices and modes of expression that literates can learn to help them process the information displays efficiently.

2. *Spatiality*. Unlike speech, graphic information displays can be arrayed in space. Signs can be placed on doors, over buildings, alongside highways, and so forth; pages of print with words layed out spatially to permit the recreation of a temporal flow of speech can be constructed; forms can be developed with "slots" containing labels ("Name;" "Address;" etc.) and myriad other graphic tools to accomplish various information transmission and processing tasks can be developed (labels, lists, bus schedules; flow charts; tables; schematics; transparencies; and so on).

In mathematics, spatial layout becomes especially important in the concept of "place value." In teaching reading, students may be taught to read graphs or figures, or to analyze text materials using such graphic devices as "semantic networks," outlines, tree structures, and other devices that depend for their effectiveness on the fact that the more of less permanent, graphic displays can be arrayed in space.

Spatiality is especially important in the use of graphic displays for analysis and synthesis. For each of the three types of analysis identified by Upton [10] there is a primary graphic device. For *classification*, in which objects or events are analyzed by features and then sorted into categories, the *matrix* is the primary graphic device. With lines forming rows and columns that intersect to form cells (graphic "pidgeonholes"), information can be sorted into various cells to fit category headings of columns and rows. The white space of an empty cell serves as an information processing aid, and reminds one to look for information that might fit the cell .[11]

For *structural* analysis, in which the relative location of objects and/or their parts is of importance, pictures, schematics, block diagrams tree structures, or similar devices that display information spatially are the primary tools of analysis. Devices such as tables of contents and indexes display the relationships among the parts (chapters) and contents (indexed terms) of a text to the total book.

For *process* or procedural analysis, in which the sequencing of events over time is the object of analysis, the *flow chart* is the primary graphic device. With the use of special symbols such as arrowheads, the steps required to accomplish some task can be arrayed spatially, read sequentially and guide the task performance of the reader.

With each of these graphic tools, the products of analysis are synthesized into a new display in which the spatial aspect of the graphic display permits and facilitates important information processing functions. A large amount of the success of such displays reflects the fact that they take advantage of visual perception. For instance, things grouped together in close proximity tend to be perceived as distinct from other things and as belonging to one another. This is a useful method for uniting perceptual and semantic "chunking" to aid in overcoming memory load and for organizing information for learning, as in the use of "mind maps" or other forms of semantic networks .[12]

Light. The third major feature of graphics technology that is drawn on in literacy is the use of light. The marks that are made to produce such graphic symbols as written or printed words, numbers, arrowheads in procedural flow charts, the white space of the cells in a table (matrix) and so forth are constructed by structuring the light that leaves the surface of the graphic medium such that the eye can detect the structure in the display.

The properties of light that are used most in graphics technology are brightness and color. Brightness provides the contrast that makes writing possible. That is, the "black" of the line of writing (or type) is in contrast to the "white" background. Brightness provides contrast that can be used in conjunction with permanence and spatiality to aid information processing, such as the use of "white space" in arranging information spatially on pages to facilitate semantic "chunking" for learning.

In addition to aiding in overcoming *memory* limitations and facilitating learning through various semantic "chunking" and organizing devices, the properties of light are extensively used to aid *attention* during information processing. **Bold print** may be used to call attention to certain information and *color* can guide information processing, as when a red line is used in an electronics diagram to permit a particular circuit to be traced in an array of circuits printed in black.

Learning strategies instruction may include pre-reading activities in which bold faced, italicized, or segregated (as by white space) words or phrases are first surveyed to activate prior knowledge about what is to be read in greater detail. This is done to increase comprehension and make learning more effective.

Study techniques such as highlighting or underlining with colored pens use the electromagnetic spectrum as tools for focussing attention and reducing the amount of information that must be processed in a second reading (itself a learning strategy made possible by the permanence feature of graphics technology).

As with all technology, the power of graphics technology arises from its use to develop tools for amplifying and extending human capabilities.[4] However, unlike hammers, sewing machines, automobiles, and other technologies that extend human strength, dexterity, or locomotion abilities, graphic technologies gain their power from their application to the extension of human cognition and the ability to manipulate information in symbolic form.

In particular, the merging of graphics technology with spoken language, itself a form of human technology for communicating with symbols, produces the power behind, and the awe and appreciation of, literacy.

The Graphic Representation of Spoken Language

The capstone achievement in graphics technology was the development of the *alphabet*, a relatively simple technology by means of which a few graphic marks can represent enough aspects of the oral language that the marks permit a reader to reconstruct a language-based message from the graphic display .[6] The importance of this is that it permits graphic language to draw on the power of oral language for representing and communicating knowledge, while bringing the power of the three features of graphics technology to bear on the development of new knowledge and tools for thinking and problem solving.

For those adults with little or no reading ability, instruction generally centers on *decoding* or reconstructing a spoken message from the graphic display or "code." The written display is called a "code" because it is considered an alternative representation of speech. In a simple substitution code one element in a message, such as the sequence 1,2,3 is substituted by another set of symbols, such as a,b, and c. In decoding, then, a is converted to 1, b to 2, and c to 3.

Though such a simple, one-to-one correspondence of speech and graphic symbols does not hold over the full range of the English language, enough correspondence is there to make the technology work. In the teaching of decoding by the *principle of the alphabet* [13] learners are taught to substitute a speech sound for a graphic alphabet symbol (phonics).

In teaching writing they are taught to make alphabet characters that can, in turn, represent speech sounds.

Of course, the success of this phonics approach depends upon the learner's ability to detect the different sounds in speech and to then associate the graphic symbol to the spoken symbol. Because some learners have difficulty in both these activities, methods have been developed in which instruction first aims to ensure that the sounds of speech can be discriminated, and then mnemonic systems are used to aid the learning of what are essentially arbitrary associations of graphic and spoken symbols.

In the Auditory Discrimination in Depth (A.D.D.) program the discrimination of speech sounds is taught using a number of graphics aids, such as big pictures of the lips, the tongue and other illustrations that depict the *place* (lips together versus apart, etc.) and *manner* (voiced or unvoiced) of articulation of speech sounds.[14] This approach teaches how speech is made and provides conceptual awareness of the segments of speech, a body of knowledge that can be used to understand how oral language is produced and a mnemonic system that can be used to learn the arbitrary sight-sound correspondences involved in reading.

Various volunteer tutoring programs teach decoding using some form of mnemonics to learn sight-sound associations. However, they do not routinely teach conceptual awareness of speech segmentation first, as in the A.D.D program. This may or may not pose a problem depending upon how aware the learner is of the sounds of speech. It is a factor that should be considered when teaching the associations used in reading decoding to adults (or children, too, for that matter).[15]

The creation of phonemic awareness and the use of mnemonics is important when it is understood that in teaching phonics or other decoding techniques we are teaching *knowledge*, that is, an organized body of facts about the alphabet and speech. Most often the teaching of decoding is referred to as teaching decoding *skills*. This is misleading, however, because one cannot teach skills. Skills have to develop through practice guided by modeling and coaching. What we teach when teaching decoding is a set of facts (e.g., this sight goes with this sound). We know that in learning bodies of arbitrary facts, methods such as mnemonics, systematic organization by rules that aid recall, and explanations that lead to understanding can facilitate learning. Sometimes, by thinking in terms of skills, teachers forget to use what is known about teaching knowledge. By keeping in mind the knowledge that is being taught in decoding, learners can be taught more successfully and expeditiously the knowledge they need to develop the skill they need for reading.

Writing and reading. It is particularly advantageous to teach reading by introducing learners to writing. This is a useful way of further clarifying the fact that the alphabet is a graphic technology for representing spoken language. In writing, ideas are first expressed (encoded) in spoken form and then recoded into written form. This emphasizes the importance of *meaning* in reading by helping learners understand that just as in writing, wherein one starts with meaning, in reading one aims to end up with meaning.

The importance of meaning in both writing and reading can be introduced by first having students represent their thoughts in a non-language based graphics technology - pictures. For instance, a learner may be asked to draw a picture illustrating the sentence, "The car stopped at the crosswalk." This teaches that (1) meanings, thoughts, or, more generally, *knowledge* comes first, and (2) knowledge can be represented using graphics technology. This understanding can be extended to explain that, just as drawings may represent knowledge expressed in the spoken language, the written language is a form of "drawing" that can represent the spoken language.

By thinking of writing and reading together as the use of graphics technology for producing and communicating knowledge (meaning), the issue of whether reading is best thought of as a "bottom-up" or a "top-down" process is addressed.[1] Clearly, in writing, the goal is always to construct and communicate knowledge, and that entails the formulation of a plan for communicating and the possession of knowledge that can be represented first in the spoken language and then in the written language. Thus the representation process proceeds from the "top-down." But just as one cannot comprehend spoken language without attending to what is being said, one cannot comprehend the written language without first looking at the graphic display, and therefore reading entails processing that is "bottom-up."

It may be important to teach the adult new reader that the goal of reading is to use the written word to construct meaning, as in some of the "whole language" approaches .[1] This may be necessary because the attention needed to learn the written code may cause the learner to concentrate so much on the decoding process that insufficient attention is given to trying to understand the message.

KNOWLEDGE, THE HUMAN COGNITIVE SYSTEM, AND READING

Just as the oral language is used to represent knowledge (ideas; thoughts) in the acoustic medium, the alphabetic writing system is used to represent knowledge in the graphic medium. In both these cases, knowledge is both the beginning and end product of communication.

Because knowledge can be represented in different modes, as in drawings, speech, written language, dance, and so forth, it is useful to consider the person as possessing a knowledge base that can be operated on by different sets of procedural rules (themselves a part of the knowledge base) to represent the knowledge. Figure 4.1 in Chapter 4 presents a very simplified model of a human cognitive system (HCS). The system has a long term memory in which the knowledge base is stored, a short term or working memory that is actively involved in processing information, and a sensory/perceptual system for picking-up and placing information in the environment.

When the person is listening to speech, the HCS is picking up information in the acoustic medium and simultaneously picking up information from the *internal* knowledge base and merging the two to comprehend the message. Similarly, in reading, the person picks-up information from an *external* store of knowledge (a book; sign; list; table; etc.) and merges it with knowledge picked-up simultaneously from the internal knowledge base.

From this model, it is clear that *the success of reading for comprehension rests upon*

(1) the possession and access of content knowledge relevant to what is being read;

(2) the possession and access of task-relevant information processing (procedural) knowledge, including planning or goal-setting (metacognitive) knowledge and knowledge of strategies for learning from texts; oral language representation knowledge (grammar:lexicon and syntax); communicative knowledge (such as questioning for clarification) and written language representation knowledge, including various

communicative conventions developed by literates over time (such as topic sentence and supporting details in expository materials) and

(3) an external information display that can be accessed, scanned (read), and transformed into an internal representation in working memory for use in performing some task (reading-to-do) or with transfer to the long term memory or knowledge base when learning is desired (reading-to-learn).

Organizing these various components and processes of the human cognitive system into a program to help adults expand their knowledge of and skill in using graphics technology for reading is a formidable task. How one proceeds depends in large part upon the needs of the adults being served and the instructional contexts (see Chapter 3). For instance, adults with the absolute minimum knowledge of the alphabet, writing, and phonics require education in the alphabetic principle and its use in reading. There will be a need for extensive practice in decoding before these adults can give a skillful reading performance.

Though it is not always the case, most adults who possess the very least knowledge of and skill in reading will also possess poorly developed oral language ability, and particularly a poorly developed lexicon. They will require extensive knowledge development in a wide array of domains if they are to become broadly literate, as defined above.

While there are perhaps some 5-10 percent of adults over the age of 15 years who read at or below the level of children in the 4th grade (some 10,000,000 or more) [16], the largest percentage (40-50%) of adults who enter reading programs are "mid-level" literates, with reading abilities in the 5th through 9th grade levels .[17]

For these "mid-level" literates, reading programs must be carefully tailored to their needs and the contexts in which they wish to function. They tend to leave programs after only a relatively few (25-100) hours of instruction without developing the very broad knowledge needed to be more generally literate, nor greater depth in a limited domain to be more specialized. (In fact, most programs do not even make this distinction of breadth and depth in learning, and hence do not systematically address these different dimensions of literacy).

Engaging in Literacy Practices to Become Highly Literate

Quantitative data from assessments of adult literacy in 1937, 1973 , and 1986 suggest what might be called the "triple helix" of literacy development: skill, practice, and education.[18] A salient finding across the last half century is that people with higher levels of education have higher levels of literacy skill and they engage in higher levels of literacy practices, i.e., they read books, magazines and newpapers more frequently than do the less educated and less skilled.

Data on the intergenerational transfer of literacy shows that better educated parents tend to have children who achieve better in school.[18] A considerable body of evidence indicates that preschool children from homes that have higher income levels and where parents have higher education levels frequently acquire considerable oral language vocabulary and literacy knowledge before they enter school (see chapter 1). These children have typically engaged in some forms of *literacy practices*, such as scribbling with pencils and crayons as "pre-writing", and perhaps they have even learned to print their names and other words.They may have been read to and developed knowedge of the "sound of printed language." They may have learned the alphabet and even how to read simple stories.

When children who have engaged in pre-school literacy practices and developed pre-school literacy skill enter school, they tend to do better in school, and the school directs their reading into areas that they might not engage in otherwise. As children and other people read more and more widely, they develop higher levels of information processing skills involved in recognizing printed words and other features of the written language, and they learn the meanings of more and more words, i.e., they develop more extensive bodies of knowledge. This in turn helps them do well in school, so they pursue further education. This guides them to engage in additional reading practices, and, in turn this helps them develop more efficient reading skills and helps them acquire more knowledge.

The Importance of Practice for Literacy Development. There is a growing body of evidence to suggest that children's development of literacy skill across the school years results to a large extent from the reading they do outside of school. [19,20] Anderson, et. al. reported a wide range of amount of reading of books, magazines, comics, and mail for fifth grade students in a year.[20] Children at the 30th percentile of amount of out-of-school text reading read about 251,000 words a year. While children at the 70th percentile of amount of out-of-school reading read some 1,168,000 words a year. Amount of reading was significantly related to reading achievement.

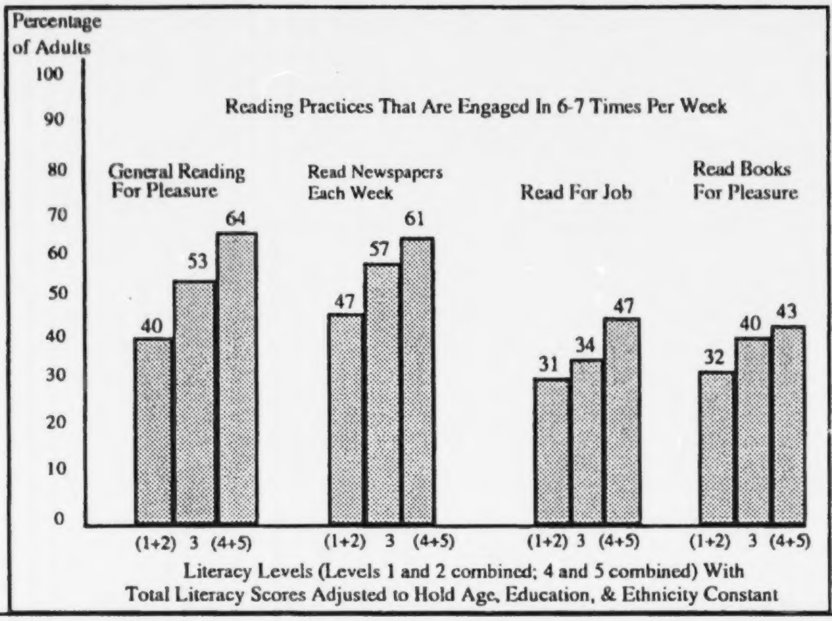
Children in the 3rd through 6th grades with reading skills at the 25th percentile have been found to lose over the summer almost half of the skill they gain during the school year. While those at the 75th percentile actually gain skill over the summer [21] (Barbara Heynes, p. 37, Figure 10).

Among adults, higher levels of engagement in reading practices has been found to be associated with higher levels of education, vocabulary, and cultural knowledge, such as knowledge of names of famous authors, magazines, and other people.[22]

The combined evidence suggests that *practice in reading*, and especially the reading of books, is a potent contributor to the development of vast bodies of knowledge in long term memory and efficiency in word recognition and other aspects of the processing of language and graphic displays of information in working memory. In turn, it is the large bodies of knowledge that a reader possesses that permits him or her to provide a *functional context* for what they read. This makes it possible for highly literate readers to contend with even poorly designed and written books and other materials that are poorly contextualized. The highly literate reader uses prior knowledge to construct a meaningful context for the text, even when the text itself does not.

The low achievement gains in the pre- and post-test scores of adult literacy programs reported in Chapter 3 may reflect low levels of practice in reading by students outside of the literacy programs (or, for that matter, inside the program. We have very little information on "time on task" in adult literacy classrooms or learning centers). To date there is very little information about the extent to which adults increase their out-of-class reading as a consequence of participating in adult literacy programs. The data above would seem to suggest that if such programs do not lead to fairly large increases in out-of-class reading, then the adult learners are not likely to develop the vast bodies of knowledge and efficient information processing skills needed to achieve high levels of literacy.

Figure 6.1. Knowledgeable adults read more.
Using an innovative telephone method researchers assessed the literacy knowledge of adults in the San Diego area. Based on their scores on simple checklists of famous people, famous authors, well-known magazines and vocabulary, adults were divided into five literacy knowledge levels, with levels 1 and 2 at the low end, level 3 in the middle, and levels 4 and 5 at the high end. This figure shows that, when age, education, and ethnicity are held constant, adults with higher literacy knowledge read more frequently than the less knowledgeable adults. This is consistent with the hypothesis that people who read more know more. [26]



Loss of Literacy Ability

Some evidence exists to suggest that adult students who leave literacy programs may not only fail to develop additional literacy skills if they do not engage in further literacy practice, but also that they may actually, and fairly rapidly, lose new found skills if they are not practiced after the program [23] (p. 118). Literacy students who received job-related reading training and then went on to job technical training were retested about eight weeks after leaving the literacy program. It was found that at the end of the six week literacy program the students had gained 2.4 reading grade levels (RGL) of skill in job-related reading. Eight weeks later, after completing job technical training, that gain dropped to 1.9 RGL, for a retention rate of 80 percent. However, while gain in general literacy was about 1.0 RGL at the end of the job-related literacy program, eight weeks later that gain had dropped to 4 months, for a retention rate of only 40 percent of what had been gained in general literacy.

The foregoing suggests that although the amount of reading practice may have dropped when the students left literacy training and entered job technical training, they nonetheless continued to practice reading job-related materials. This may have helped them maintain their gain in job-related literacy. However, since it is likely that they did not engage in as much reading practice as during the literacy program, this may have contributed to their loss of most of their gain in general literacy.

BEST COPY AVAILABLE

Chapters 7, 8, 9 and 10 present four case studies of reading programs for mid-level literates designed within the conceptual framework of adult literacy development discussed above. In these programs, the learner is assumed to possess a cognitive system with a knowledge base that needs to be expanded both with regard to knowledge of a particular vocational content domain and knowledge of and skill in using graphics technology for reading, learning, and problem solving in that domain.

References

[1] McCormick, W. (1988). *Theories of Reading in Dialogue: An Interdisciplinary Study*. New York: University Press of America.

[2] Street, B. (1984). *Literacy in Theory and Practice*. Cambridge: Cambridge University Press.

[3] Ellsworth, E. (1989). Why doesn't this feel empowering? Working through the repressive myths of critical pedagogy. *Harvard Educational Review, 59,* 297-324.

[4] Bruner, J. (1968). *Processes of Cognitive Growth: Infancy*. Worcester, MA: Clark University Press.

[5] Morris, W. (Ed.) (1976). *The American Heritage Dictionary of the English Language*. Boston: Houghton Mifflin.

[6] Harris, R. (1986). *The Origin of Writing*. London: Duckworth.

[7] Goody, J. (1977). *The Domestication of the Savage Mind*. Cambridge: Cambridge University press.

[8] Sticht, T. (1979). Developing literacy and learning strategies in organizational settings. In H. O'Neil, Jr. and C. Spielberger (Eds.) *Cognitive and Affective Learning Strategies*. New York: Academic Press.

[9] Robinson, F. (1946). *Effective Study*. New York: Harper.

[10] Upton, A. (1973). *Design for Thinking: A First Book in Semantics*. Palo Alto, CA: Pacific Books.

[11] Schwartz, S. (1971). Modes of representation and problem solving: Well evolved is half solved. *Journal of Experimental Psychology, 2,* 347-350.

[12] Dansereau, D. (1978). The development of a learning strategies curriculum. In H. O'Neil, Jr. (Ed.) *Learning Strategies*. New York: Academic Press.

[13] Liberman, I., Shankweiler, D., & Liberman, A. (1989). The alphabetic principle and learning to read. In D. Shankweiler & I. Liberman (Eds.). *Phonology and Reading Disability: Solving the Reading Puzzle*. Ann Arbor, MI: The University of Michigan Press.

[14] Lindamood, C.& Lindamood, P. (1975). *The A.D.D. Program, Auditory Discrimination in Depth*. Hingham, MA: Teaching Resources.

[15] Golinkoff, R. (1978). Phonemic awareness skills and reading achievement. In F.B. Murray & J. J. Pikulski (Eds.). *The Acquisition of Reading: Cognitive, Linguistic, and Perceptual Prerequisites*. Baltimore, MD: University Park Press.

[16] Sticht, T. (1986). Foreword. In I. Kirsch & A. Jungeblut. *Literacy: Profiles of America's Young Adults*. Report No. 16-PL-02. Princeton, NJ: Educational Testing Service.

[17] Sticht, T. & Hickey, D. (1987). Technical training for "mid-level" literate adults. In C. Klevens (Ed.) *Materials and Methods in Adult and Continuing Education: International-Illiteracy*. Los Angeles: Klevens Publications, Inc.

[18] Sticht, T. & Armstrong, W. (1994, February). *Adult Literacy in the United States: A Compendium of Quantitative Data With Interpretive Comments*. Washington, DC: National Institute for Literacy.

[19] Anderson, R., Wilson, P. & Fielding, L. (1988, Summer). Growth in reading and how children spend their time outside of school. *Reading Research Quarterly, 23*, 285-303.

[20] Stanovich, K. (1993). Does reading make you smarter? Literacy and the development of verbal intelligence. In H. Reese (Ed.) *Advances in Child Development and Behavior, Vol. 24*. New York: Academic Press.

[21] Berlin, G. & Sum, A. (1988, February). *Toward a More Perfect Union: Basic Skills, Poor Families, and Our Economic Future. Occasional Paper 3.* New York: The Ford Foundation.

[22] West, R., Stanovich, K. & Mitchell, H. (1993, January/February). Reading in the real world and its correlates. *Reading Research Quarterly, 28*, 35-50.

[23] Sticht, T. (1975, June). *A Program of Army Functional Job Reading Training: Development, Implementation, and Delivery Systems*. Final Report HumRRO-FR-WD(CA)-75-7. Alexandria, VA: Human Resources Research Organization.

[24] Soifer, R., Irwin, M., Crumrine, B.,Honzaki, E., Simmons, B., & Young, D. (1990). *The Complete Theory-to-Practice Handbook of Adult Literacy: Curriculum Design and Teaching Approaches*. New York: Teachers College Press.

[25] Sticht, T. (1990, January). *Testing and Assessment in Adult Basic Education and English-as-a -Second Language*. Washington, DC: U. S. Department of Education.

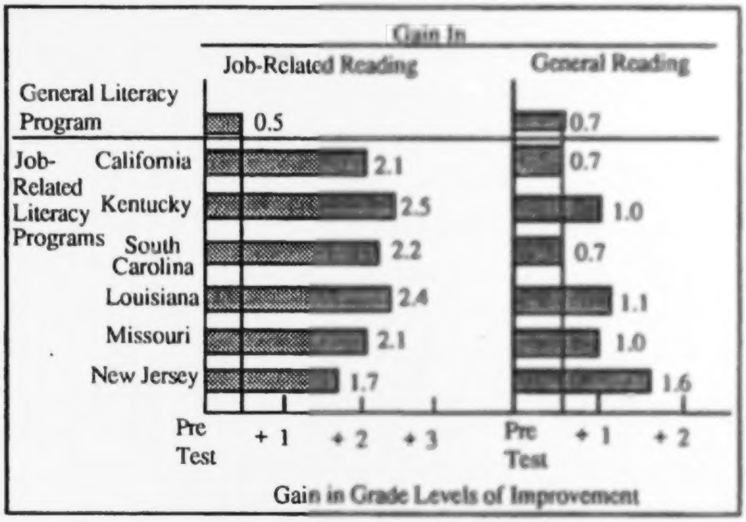
[26] Sticht, T., Hofstetter, R., & Hofstetter, C. (1997, March). *Knowledge, Literacy and Power*. San Diego: Applied Behavioral & cognitive Sciences, Inc.

Part 3

Case Studies in Functional Context Education

Teaching Basic Skills In The Context of Job Skills Training

Research in the early 1970's provided the foundation for much of the federal policies and practices in workplace literacy education of the 1990's. In the early research, it was demonstrated that in a brief, six week program, with up to 180 hours of instruction available, adult students in programs that taught literacy skills using general literacy materials, such as literature readers, skills books, etc., made about a half-year gain in job-related reading and about seven months gain in general literacy. But students in literacy programs that used job-related materials, such as technical manuals, texts about the jobs, job forms, etc., made as much or more gain in general literacy and *three to five times* the amount of gain in reading their job materials.



Reduce Time It Takes For Adult Students To Move To Self Sufficiency

Research sponsored by the Ford Foundation in the mid-1980's in the San Diego Community College District, Centre City Continuing Education Center, showed that electronics training could be redesigned to take in people with basic skills below what is normally expected. They were then taught reading and mathematics in the context of teaching electricity and electronics.

By fully integrating job skills and basic skills training, the amount of time it takes an adult to move from welfare-to-work can be reduced. This is because it is not necessary to first raise student's basic skills to some pre-determined level before entering job training. Instead, one can enter directly into job training, and then improve basic skills by doing job-related reading, writing, oral language, and mathematics tasks. Further research is needed to find ways to fully integrate the vocational and basic skills programs in public institutions in ways that give adults access to vocational training for high-paying jobs, reduce the total training time, and still generate sufficient full time equivalent (FTE) funds to support the programs.

Source: Sticht, T., Armstrong, W., Hickey, D. & Caylor, J. (1987). *Cast-off Youth: Policy and Training Methods From the Military Experience*. New York: Praeger (p. 116).

BEST COPY AVAILABLE

Chapter 7

Functional Context Education Case Study #1: The Functional Literacy (FLIT) Program

Scenario: When a large organization switched from "general" to job-related literacy programs hundreds of thousands of young adults improved their ability to perform job reading tasks 3 to 5 times as much as they had in the "general" literacy program.

The Department of Defense is one organization that has had a long term interest in finding cost-effective ways to improve its recruitment function so that it may profitably utilize a wider share of the young adult population for entry level jobs. Though in the last decade, the military has been able to raise its quality standards, methods developed in earlier research and development projects have made it possible to integrate literacy and job training when it becomes necessary to utilize less educated recruits. By integrating basic skills training with job skills training, both are accomplished at less expense than is necessary when separate programs are used.

The Functional Literacy (FLIT) Program. In research on reading skills for the US. Army it was determined that, for someone to be able to read and comprehend in a given content area, such as a technical job, they must have some considerable prior knowledge about what they are reading. For instance, it was found that the personnel who scored high on tests of general reading ability did so because they had higher levels of vocabulary, and they knew a lot about a wide variety of subjects. For this reason, personnel with higher levels of general reading were able to draw on their broad-based prior knowledge for reading and learning from job training materials.

However, it is also the case that it takes a long time to develop large bodies of prior knowledge that can be drawn on to read and comprehend job technical materials. For instance, it takes the typical high school level reader twelve years, in and out of school, to develop twelfth-grade reading skills.

If adults need to learn to read job materials , and they have only a limited amount of time to learn it - because time in training counts against productivity - then it is not possible to develop large bodies of general knowledge that will help them read job materials. However, by focusing the reading training on the contents and learning demands of the job field for which employees are being prepared it is possible to develop a fair amount of competence in both reading skills and job knowledge. This was the basis for the Army's Functional Literacy (FLIT) program.

FUNCTIONAL CONTEXT EDUCATION (FCE)

As discussed above, Functional Context Education (FCE) concepts and principles have been used to design programs for teaching basic skills and job technical knowledge together. However, the approach is more general. It is based on findings from research showing that a person can learn to read, write, or compute while working with job-related or other content material, such as parenting books. It is not necessary to first learn to read, as a sort of content-free process skill, before one starts to read to learn important content. This is particularly true for those adults with basic skills at or above the 5th grade level.

Using FCE, reading, writing and mathematics skills are taught using materials that present content knowledge that is important to the adult learner. If the content knowledge that is desired is job-related, such as learning an office, automotive, or other job, then literacy and mathematics are taught using materials about the different jobs.

If adult learners want to read to their children, then children's books may be used to teach reading skills. If broader parenting knowledge is desired, then parenting content is used to teach reading, writing and mathematics skills. If Bible reading is desired, then reading is taught using Bible-related materials.

In FCE, the learner's mental context is considered in developing educational experiences for the learner. If the learner has in mind the learning of a given job, then that is the person's mental context. Therefore, providing literacy and mathematics training within the context of job materials, fits the learner's mental context. When there is a good fit between what the learner has in mind and what is offered in the educational program, as accomplished in FCE programs, there is likely to be improvements over "traditional" programs in *motivation* to participate in programs, attend regularly, and stick with the program until completion.

Additionally, in contrast to "traditional" programs, well designed FCE programs should make *learning* easier and increase the application (*transfer*) of knowledge and skills outside the program. In turn, this should promote better *retention* of what was learned and provide a larger base of knowledge to use in *lifelong learning* and in the *intergenerational transfer* of *knowledge* and *values* for education from parents to children. This is why it is important to understand FCE and how to develop FCE in different settings.

Learning Basic Skills in a Functional Context

In chapters 7, 8, 9 and 10 principles of FCE will be illustrated in four case studies. In the present chapter, in case study #1, we discuss the program that first introduced the behavioral and cognitive science concepts that form the foundation for Functional Context Education (FCE) in adult literacy education. In this case study, a large scale employer, the U. S. Army, had a need for a new approach to literacy education after finding out that the "general" literacy programs it had implemented did not make much improvement in worker's performance of job reading tasks. The Functional Literacy (FLIT) program was developed as a job-related reading program to replace the "general" literacy programs and to improve job-related reading performance.

In Chapter 8, case #2, we enter a scenario about Carmen Lopez, a mother in the Job Opportunities and Basic Skills (JOBS) welfare-to-work program of the U. S. Department of Health and Human Services. We show how she enrolled in a prevocational training basic skills program at the ABC'S, a (fictional) community-based organization that followed principles of FCE to integrate the teaching of reading and mathematics with Office Technology and other occupational fields. The focus will be on the GOALS program that the ABC'S used to deliver integrated basic skills and job knowledge.

In chapter 9, case #3, the scenario is changed to describe the design of a new electronics program that integrated reading and mathematics instruction into the technical training. This differs from the GOALS program that Carmen Lopez studied. In that program, M. Lopez was in a prevocational basic skills program preparing to enter into a technical training program by studying reading and mathematics in the context of Office Technology in a basic skills program. In the scenario of case #3, M. Lopez enters directly into technical training that was redesigned to accommodate students with basic skills below the 9th grade. The program then develops both technical knowledge and basic skills together as a vocational training program. This case study illustrates the idea that vocational training, itself, may be in need of redesign to accommodate a wider range of students.

Cases #1, #2, and #3 illustrate the application of FCE concepts and principles to programs for learners interested in job training. In chapter 10, case #4, the scenario switches from a focus on job-related programs to programs that use FCE principles to develop the basic skills of youth and adults using content that encourages the intergenerational transfer of literacy and new attitudes and beliefs about education from parents to children. Such approaches are found increasingly in family literacy programs.

THE FUNCTIONAL LITERACY (FLIT) PROGRAM

The Functional Literacy (FLIT) program was the first adult literacy education program based on both a theoretical body of knowledge that has since come to be called "cognitive science" and another called "instructional science." The latter represented a blend of earlier "behavioral science" and the new cognitive science of psychology.[1]

A planning paper from the Human Resources Research Organization (HumRRO) that conducted the FLIT research and development discussed several concepts that guided the development of the program.[2] These included concepts from the cognitive sciences regarding (1) the nature of the reading process and (2) the nature of the learning process. From the behavioral or instructional sciences, the planning paper discussed (3) the instructional process and (4) the process of bringing about institutional change to facilitate the implementation of the FLIT program in an operational setting.

(1) *The Reading Process.* In the FLIT program reading was considered as a psycholinguistic process as discussed by Kenneth Goodman[3] involving the combined use of fundamental psychological processes (perception,cognition) and linguistic processes (phonology, grammar, semantics). Goodman's work later became the foundational knowledge base for what became known as "whole language."[4]

The psycholinguistic approach to reading as applied to FLIT followed the developmental model of Chapter 5. It emphasized a developmental sequence in the acquisition of reading skills which proceeds as follows: first, early in life the new infant adapts to his or her world by means of the basic processes of perception and cognition. Eventually (in the usual case) these processes are brought to bear on the acquisition of language skills. The latter are typically developed through the processes of speaking and listening: the *oracy* skills. Following the development of oracy skills, reading skills may be acquired if the person is in a literate society. The literacy skills consist of reading and writing and represent alternative modes of expression and reception of the same language base developed through listening and speaking. Writing is the visual form of the spoken language (though, of course, there are some important features unique to both oracy and literacy).

The psycholinguistic approach to literacy followed in FLIT emphasized both cognitive and language skills. By this approach, for FLIT students to achieve higher levels of literacy skills, they would need to achieve higher levels of cognitive (reasoning) skills used in conjunction with language, and for reading comprehension of job materials to occur students would need to have a body of job knowledge that could be expressed and comprehended in oral and written language. The development of higher order, analytical reasoning skills and bodies of job knowledge were developed in the FLIT program in what was called Strand 2: Reading to Learn (see below).

(2) *The Learning Process.* In the FLIT project, learning was construed as an information processing activity. The information process approach to learning emphasizes internal mental processes in learning as the result of an active, constructive process on the part of the learner, a position that later became known as *constructivism..*[5] The constructivist position differs from a strict behavioristic conception of learning in which the

person is viewed primarily as a passive, reactive being, whose learned responses are the result of some automatic process of association among stimuli and responses.

For the FLIT developmental program, the most important aspect of the information processing approach to learning was the emphasis upon the active, construing (constructing,interpreting) nature of the learning person. This suggested that instruction should be designed that would stimulate active information seeking and processing, particularly of the type indicated in prior research to be involved in important job-related functional literacy skills, e.g., learning how to locate information in job manuals, how to follow procedural directions in a manual, etc. These types of active information processing activities were included in the FLIT program in what was called Strand 1: Reading to Do (see below).

(3) *The Instructional Processes:* The instructional processes differed for the Strand 1 and Strand 2 components of the program. The Strand 1 processes were derived from behavioral and instructional science as methods of instruction that had been empirically demonstrated to enhance learning. Some of the Strand 1 processes were derived primarily from programmed instructional techniques and some from what were later to be called *competency-based adult education* (CBAE). These included:

(a) *Individualized, self-paced instruction.* This permitted students to work their way through the Strand 1 materials at their own rate using authentic printed materials from their particular job fields.

(b) *Programmed instruction.* The Strand 1 curriculum consisted of six separate linear sequenced modules of instruction each with pre- and post-module tests with *mastery criteria of both speed and accuracy* for competency-based progression through the sequence of instructional modules.

(c) *Peer-assisted instruction.* Students were given responsibilities both for records management in the program, which reduced the teacher's administrative, paper-processing load, and in some cases, for tutoring less advanced students.

The Strand 2 instructional processes were based more on cognitive science concepts related to the learning of complex subject matters and included:

(d) *Constructivist activities:* Students worked collaboratively in teams on complex reasoning projects involving classification, structural analysis, procedural analysis and the construction of complex graphics displays.

(e) *Transformation among multiple modes of representation.* Students transformed information given in written modes into new representations using drawing of pictures, matrix and flow chart constructions, and then they transformed their new graphic representations into oral language in summarizations of their projects.

(f) *Functional contexts for instruction.* The students used authentic job materials which helped them see the purpose for the reading training in concrete terms of job proficiency, not as decontextualized, remedial, general educational development at which they had failed many times in the past. The *problem-based* methodology for Strand 2 provided *anchored instruction* to motivate learning and to develop accessible (as contrasted to "inert") knowledge. It developed literacy and cognitive skills situated in job-related contexts (i.e., *situated cognition*) to promote transfer of skills and knowledge from the classroom to job training and eventually to the job itself (see references number 5 and 6 for further discussions of and references to anchored instruction, situated cognition, problem-based learning and related ideas).

(4) *The Process of Change.* In designing an instructional system which is supposed to replace ongoing systems, it is necessary that provisions be made to ensure that the new program is understood and accepted by those who will use it. To this end, administrators and instructors were consulted prior to the development of the FLIT program to determine problems with the ongoing basic skills programs, and to solicit ideas to be incorporated into the new program. The FLIT developmental package included an implementation workshop that was presented to administrators and teachers at the various sites at which the FLIT program replaced the ongoing general literacy programs. For six months following the implementation of the FLIT program at six sites around the nation, the development team stayed in contact with programs, collected follow-on data for quality control, and provided advisory services to administrators and teachers.

The FLIT program developed job-linked reading programs for personnel with low reading skills who were assigned to become Cooks, Automobile Repairmen, Communications Specialists, Medical Corpsmen, Combat Specialists, and Supply Specialists. In the FLIT program, the role of prior knowledge in reading and comprehending job materials was recognized by teaching reading of job materials to personnel in a six week program before they entered job technical training.

To develop the FLIT programs for each of the job domains, it was necessary to determine the goals or objectives for the programs, develop assessment instruments to measure improvements in job-related reading, and design and develop the job-related reading curriculum.

Setting Goals for Entry and Exit

To set the goals for the job-related reading program, two different approaches were used. In these approaches, the goals of the job literacy program were established in terms of:

(1) The specific job reading tasks inherent in learning and performing the job. These tasks were used to develop job reading task tests for measuring job reading skills on entry into the program and at the end of the program (pre- and post-test measures of job-linked reading skills) and for developing the reading instructional materials.

(2) Correlations among general reading skills and measures of job proficiency including job knowledge and job sample test performance. These correlations were used to identify the lowest general reading level that was associated with *not* being over-represented in the bottom quarter of performers on the job knowledge and job sample performance tests. This criterion identified the 7th grade level of general reading as the minimum level for job-related reading in the FLIT program.

To provide an estimate of student's job-related reading skills in terms of general reading ability, correlations were determined for reading on general reading tests and specially constructed job-related reading task tests. The correlations were then used to scale performance on the job reading task tests in terms of reading grade levels. It was thus possible to determine if personnel were reading at the 5th, 6th, 7th, 8th, etc. grade level on their job reading tasks.

To qualify for the FLIT program, new recruits had to perform below the 6th grade level three times in succession, with two week intervals in between testings, using a general reading test. This ensured that the personnel were actually lower level readers and reduced regression to the mean statistical artifacts when post-testing was accomplished. Finally, candidates for FLIT had to score below the 7.5 grade level on both a general and a job reading task test during in-processing into FLIT to remain in the program. The requirements for scoring below the 6th grade level to be assigned to FLIT or above the 7.5 grade level to leave without taking the program was established to account for errors in estimation of reading skills due to fallible test instruments.

The FLIT Curriculum

The FLIT curriculum consisted of two separate "strands" of activities: Strand 1: reading-to-do and Strand 2: reading-to-learn. The *reading-to-do* strand taught personnel how to use their manuals as reference materials. Research at job sites had indicated that three-quarters of work reading tasks engaged working memory processes and involved looking up information, holding it in working memory to accomplish some job task, and then it could be forgotten. For instance, the automotive repairman might have to look up the proper amount of torque for tightening a lug nut. Or a supply clerk might have to look up the code for a piece of equipment to be ordered. A medical corpsman might have to read and follow the four life saving steps in a course on first aid. In reading-to-do tasks, then, the person does not have to learn the material - just locate, extract, and use it to accomplish a given task.

Figure 7.1 shows the sequence of instructional modules that were developed for each of the six job reading programs. For some programs, such as Communications, Combat, Clerical, and Automotive Repairman, more than one job was included. For example, Communications included Wireman, Radio Operator and other similar jobs. Thus, one job-related reading program was made for this "cluster" of jobs. This was true for the other jobs mentioned, too. Only the Cook's and Medical Corpsmen's programs addressed one job.

The five modules in the reading-to-do strand included how to read and use tables of contents, indexes, tables and graphs found in the job materials, how to locate and read specifications, etc. in the body of a manual, how to read and follow procedural directions, and how to complete job forms using the information in the manuals and on the forms themselves.

Each module was preceded by a pre-test which, if passed, permitted the person to move on to the pre-test for the next module. If the pre-test was failed, then the person entered the module, completed 10 self-study worksheets, and then took a post-test. If the person failed the post-test, a second set of 10 worksheets was completed and a different version of the post-test was taken. This time, whether the post-test joint criteria of 90 or more correct in 20 or fewer minutes was reached, the person was moved on to the next module to ensure that each student spent some time on each module.

Worksheets were developed following two general guidelines: first, ask questions that will guide the student's attention to the *structure* of the job reading materials, then to the *content*; second, arrange the exercises on the worksheet so that they go from *simple* to *complex*.

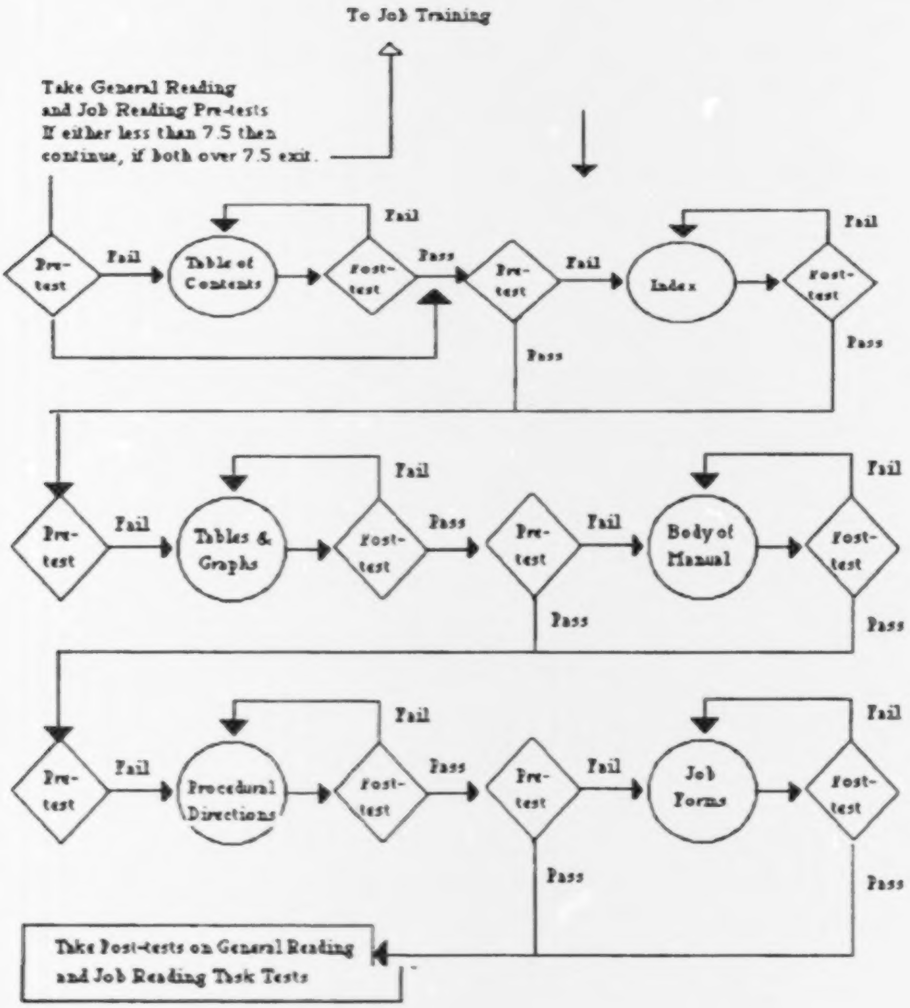

To Job Training
Take General Reading
and Job Reading Pre-tests
If either less than 7.5 then
continue, if both over 7.5 exit.
Pre-test
Fail
Table of Contents
Post-test
Pass
Pre-test
Fail
Index
Post-test
Fail
Fail
Pass
Pass
Pre-test
Fail
Tables & Graphs
Post-test
Pass
Pre-test
Fail
Body of Manual
Post-test
Fail
Fail
Pass
Pass
Pre-test
Fail
Procedural Directions
Post-test
Pass
Pre-test
Fail
Job Forms
Post-test
Fail
Fail
Pass
Pass
Take Post-tests on General Reading
and Job Reading Task Tests

Figure 7.1. The five modules in the Functional Literacy (FLIT) program reading-to-do tasks. This curriculum strand was available for each of five jobs: Cooks, Combat, Communications, Medical Corpsman, Automotive Repairman, and Supply Clerk.

To illustrate the application of these principles, Figure 7.2 shows a page from the table of contents of a medical corpsmen's manual (the actual table of contents used in the program was several pages long). On the first worksheet in the Table of Content module, questions were asked such as, How many Chapters are in this manual? How many sections are in Chapter 1 of this manual? How many paragraphs are in Section II of Chapter 3? These types of questions guide the student to forming an understanding that the manual has a structure and that this structure can be used for locating precise information.

literacy program were identified through the study of job skills training program curriculum guides, materials, and consultation with job training instructors. In each job reading program, 12 major topic areas were identified, and specific knowledge objectives were developed for each topic area.

For each of the 12 job topics, a 300-400 word passage was written that included the knowledge objectives for the topic area. The passages were written without the redundancy and elaboration typical of textbooks, because in the reading-to-learn activities students performed repeated readings of the materials, sometimes alone and at other times with teams, to construct different representations of the information in the passage. For instance, as illustrated in Figure 7.3, a medical specialist would be assigned to read the topic passage on First Aid and to then draw pictures illustrating what the written passage said. Then, the student would study the passage again to prepare a flow chart of the four lifesaver steps in first aid.

In addition to the above activities, students were also engaged in reading passages that contained types of equipment, their uses, advantages , disadvantages, and so forth. Then, by studying the passages students constructed tables (matrices) with columns and rows and cells that could be filled in using the content of the passage. Through these "representation transformation" activities, students performed multiple readings of texts and elaborated them by constructing pictures, matrices, or flow charts. The latter activities required that the new knowledge in the passages be "mixed" with the student's prior knowledge for full comprehension to occur.

To help students learn to precisely analyze sentences of the passages, a simple grammar was taught that emphasized that all sentences consist of a "main idea" and "more about the main idea." More about who, what, when, where, why, how and more about the subject of the sentence. Exercises using sentences from the passages were developed to help students "parse" the sentences using the simple grammar.

Finally, for some students with very poorly developed word recognition skills, individual vocabulary exercises were developed that included drill on recognizing the written versions of words that were either already in the student's speaking vocabulary, or which were taught by the instructor and then practiced by the student in reading aloud activities.

In practice, students worked in the opposite sequence from that discussed above. That is, first work was given at the word recognition level, then at the sentence parsing level, and finally in "parsing" the entire passage into pictures, matrices, or flow charts. Not all students required extensive work at the first two levels, and so they moved quickly to the passage analysis tasks.

In addition to the job-linked material, the FLIT schoolhouse had available a small library of paperback books, newspapers, and general adult basic education materials that students could read on breaks during the six hour training day.

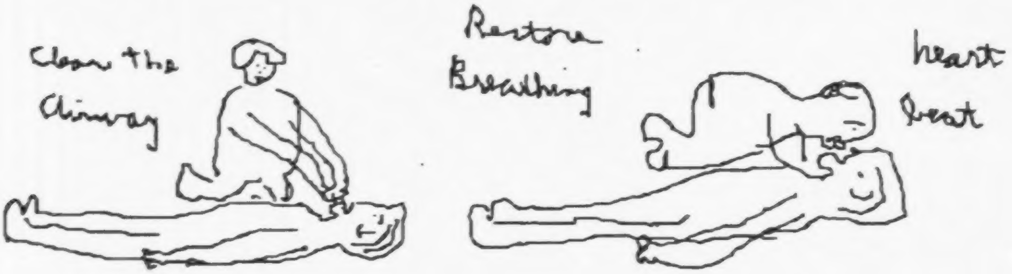
First Aid

Text Representation of Lifesaver Step 1

In combat or on the field, doctors and medics can not be every place to treat injuries as they happen. You may have to give fast emergency care to yourself or to someone else. Such emergency medical care before a doctor or medic can see the patient is called first aid. The most immediate first aid steps are the four basic lifesaver steps. Follow these steps in order: (1) clear the airway and restore breathing and heartbeat,...(2), etc.

The first step must be done immediately. The injured person's life may depend on it. He can not breathe if something blocks his mouth or throat. Take out anything from the mouth that does not belong there. If the person still can not breathe, give him artificial respiration. The best method to use if you can is the mouth-to-mouth method. ....

Picture Representation of Lifesaver Step 1: 7th grade level reading student


Clean the Airway
Restore Breathing
heart beat

Flow Chart Representation of Lifesaver Step 1: same student

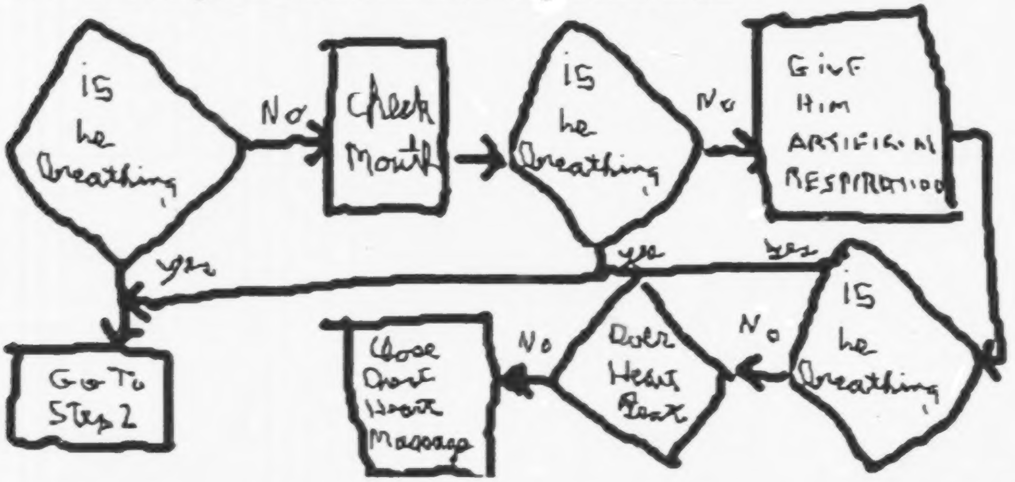

IS he Breathing
No
Check Mouth
IS he Breathing
No
GIVE HIM ARTIFICIAL RESPIRATION
yes
yes
yes
IS he Breathing
No
Does Heart Beat
No
Close Chest Heart Massage
Go To Step 2

Figure 7.3. Examples of reading-to-learn tasks in which students read a text, then draw a picture of what they have read, then reread and make a flow chart. These repeated readings and re-representations of the text materials leads to (1) increased job knowledge and (2) methods for studying to improve learning by reading.

BEST COPY AVAILABLE

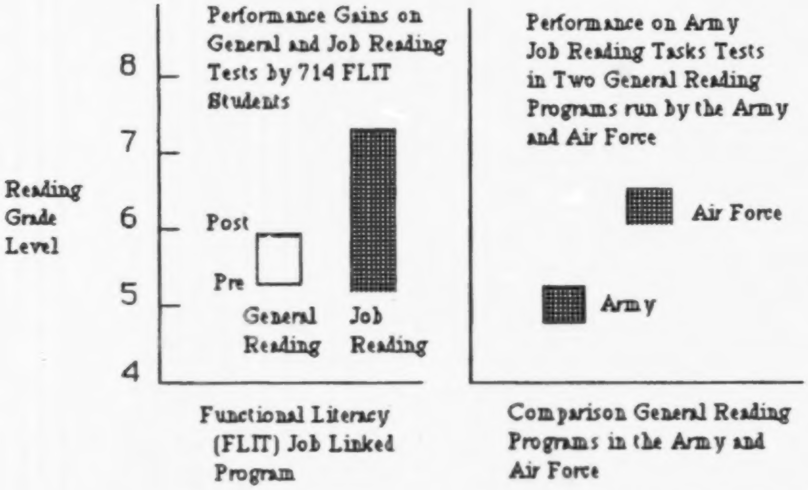


Figure 7.4. Data showing pre- to post-test gains on general reading and job reading tests for FLIT students. Gains in job-linked reading were 3 times those in general reading. Students in two comparison groups, a six week general reading program taught by the Army and a 13 week general reading program taught by the Air Force made only small gains in reading job related materials in the Job Reading Task Tests.

Evaluation of the FLIT program. Achievement data for the FLIT program included pre- and-post-test data on general reading tests and job related reading task tests. As indicated in Figure 7.4, the job-linked reading program produced three times the amount of gain in the six week program as it did in general reading: 21 months versus 7 months. The FLIT program also made more than three times the gain in job reading skills as the regular Army six week general literacy programs in place at the time. It also far exceeded the gain in job reading skills made in a thirteen week Air Force general literacy program. This is important because both the Army and Air Force general literacy programs aimed to improve personnel skills in reading military job materials. Yet, the use of general literacy materials did not bring about the desired transfer to job-linked reading.

It should also be noted that the FLIT program's seven month gain in general reading ability was equivalent to what most Army general literacy programs achieved. Thus there is much more transfer from job-linked reading training to general literacy than there is the other way around in these types of relatively brief programs.

Retention of literacy skills. To examine the retention of end-of-course reading gains in both general and job-linked literacy, 97 students were followed-up eight weeks later and retested.On the general reading test, the students had left the six week FLIT program with a gain of l0 months from pre- to post-testing. Eight weeks later only 40 percent (4 months) of this gain was retained. In job-linked reading, students had left the FLIT program with 24 months gain and some eight weeks later they retained some 80 percent (19 months) of this gain. Thus, not only was job-linked literacy training more effective in increasing job reading skill, the newly developed skill was also retained better as the students applied what they had learned in the literacy program to their job technical skills training.

References

[1] Glaser, R., Pellegrino, J., & Lesgold, A. (1978). Some Directions for a Cognitive Psychology of Instruction. In: A. Lesgold, J. Pellegrino, S. Fokkema, & R. Glaser (Eds.) *Cognitive Psychology and Instruction.* New York: Plenum Press.

[2] Sticht, T. (1982, June). *Basic Skills In Defense*. Professional Paper 3-82 (HumRRO-PP-3-82). Alexandria, VA: Human Resources Research Organization.

[3] Goodman, K. (Ed.) (1968). *The Psycholinguistic Nature of the Reading Process.* Detroit: Wayne State University Press.

[4] Soifer, R., Irwin, M., Crumrine, B.,Honzaki, E., Simmons, B., & Young, D. (1990). *The Complete Theory-to-Practice Handbook of Adult Literacy: Curriculum Design and Teaching Approaches*. New York: Teachers College Press.

[5] Duffy, T., & Jonassen, D. (1991, May). Constructivism: New Implications for Instructional Technology? *Educational Technology, 31*, 7-12.

[6] Cognition and Technology Group at Vanderbilt. (1990, September). Anchored Instruction and Its Relationship to Situated Cognition. *Educational Researcher, 19,* 2-10.

Chapter 8

Functional Context Education Case Study #2: A Pre-employment, Job-Related Basic Skills Program

Scenario A: Carmen Lopez' experience in the decontextualized Job Opportunities and Basic Skills (JOBS) training program of the U. S. Department of Health and Human Services.

Carmen Lopez is a 28 year old, single mother with three children to support. For the last three years she has been living in Manhattan supported by welfare, including Aid For Dependent Children (AFDC). Under the JOBS program, M. Lopez sought training, but when her reading and mathematics skills were assessed using standardized tests, it was found that she was reading at the 6th grade level and her mathematics skills were lower, at the 5th grade level.

To get into the training program for Office Technology that she wanted, M. Lopez was advised that she needed both reading and mathematics skills at the 9th grade level. She was informed about adult basic education (ABE) programs in the area where she lived. These programs could help her reach the 9th grade level of skill in reading and math and then she could enroll in the job training that she wanted.

When M. Lopez went to one of the ABE programs offered by a local community-based organization, she found that she was reading and doing math out of texts like those she had studied in grade school. She read general literature, did math computations and word problems in workbooks, and wrote some personal stories about her life. When she asked how long it would take to reach the 9th grade level of basic skills so she could get into the job training that she desperately needed, no one could tell her. It would just depend on her dedication and willingness to work hard at her studies.

When she read the literature and "real life" materials, and performed the numerous math exercises, M. Lopez could not see any connection between the work she was doing in the ABE class, and the job-training and work that she wanted and needed to support her and her family. So pretty soon she quit going to the program.

Like Carmen Lopez, many adults apply for job training that is offered by organizations that are using funds from the U.S. Department of Labor's Job Training Partnership Act (JTPA) or the Job Oriented Basic Skills (JOBS) program of the U. S. Department of Health and Human Services. When they apply for this training, the adults may have their reading and/or mathematics skills tested. If their skills are lower than the levels needed for job training, they may be advised to go to a basic skills program to raise their skills to the needed level.

At the basic skills program, the person may be assigned general literature materials or "life skills" materials to study, or they may work on computer-based programs that teach the basic skills. Generally, the materials they will have to read or use to study math will not be related to the kind of job that they wanted to be trained for when they first applied for job training. Too often, the adult learners cannot understand what the basic skills training has to do with the job training that was sought. So they may drop out of the program, if they ever attend in the first place.

Case Study #2: The GOALS Series of Workforce Literacy Programs

Scenario B : The ABC'S, Inc. switches from offering only decontextualized, general basic skills to FCE basic skills integrated with occupational training.

The ABC'S, Inc. is a (fictional) community-based organization located in San Diego, California. It specializes in providing job training for women, mostly single mothers. Since 1987, it has offered basic skills training for women who do not qualify for job training using standards set by the local Private Industry Council (PIC) funded by the Job Training Partnership Act (JTPA). Before 1990, ABC'S Inc. tested applicants for basic reading and mathematics skills using the Test of Adult Basic Skills (TABE). Women whose skills were below the 9th grade level were advised to enroll in the basic skills program to raise their skills to acceptable levels.

However, over time, ABC'S Inc. counselors noted that many women did not enroll in the basic skills course. And many of those who did enroll did not stay with the program until they had improved their skills to the needed levels.

One of the problems was that women needed to get into job training fast so they could graduate and get a good job as soon as possible. But when they were sent to the basic skills program, the time before they could get into training was prolonged for an indefinite period. Furthermore, the women could not see just how reading the general literature and "life skills" materials would help them in reading and learning job-related materials. And there was little understanding of how the mathematics they practiced in the workbooks they were given applied to the jobs that they were interested in getting.

Based on this analysis of the problems they were facing in their basic skills progams, ABC's Inc. decided to develop an approach to basic skills development based on Functional Context Education principles. The curriculum development staff at ABC'S Inc. had read about the importance of learning in functional contexts in several reports from government agencies. A couple had attended a workshop on functional context education sponsored by Wider Opportunities for Women.

ABC'S Inc. decided to offer pre-technical training education in Office Technology, Health Occupations, Automotive Technology, Electronics, and Construction Trades. This education would introduce students to the occupational field of their choice, and teach basic skills in the context of vocational orientation. So they looked for materials that taught both occupational and basic skills in an integrated manner and could be used by learners with reading skills mostly in the 5th to 8th grade levels.

After a long search, ABC'S Inc. found the Glencoe Occupational Adult Learning Series (GOALS) published by the Glencoe Division of the Macmillan/McGraw-Hill School Publishing Company. The GOALS was developed by Glencoe based on research and development conducted by the U.S. Department of Defense. Repeatedly this research showed that basic skills training could be integrated with occupational-related training and both could be accomplished more efficiently than either alone. Research showed that, if time for basic skills training was limited, as it is for those who need job training quickly, then the fastest way to improve job-related basic skills and qualify students for vocational training is to integrate basic skills and job skills training.

With the GOALS materials available, ABC'S, Inc. was able to quickly implement an FCE program that permitted students to develop basic skills and job knowledge together.

Scenario C: Carmen Lopez's Experience in the ABC'S JOBS program that used Functional Context Education principles in its basic skills program.

After Carmen Lopez dropped out of the general basic skills program, her case worker at the JOBS office told her about ABC'S Inc., a community-based ABE program that she could go to that would help her learn the basic skills and the job skills that she wanted at the same time.

When she arrived at ABC'S, Inc., M. Lopez told the in-take advisor about her interest in working in an office job. She was assigned a series of textbooks about the field of Office Technology. One text was a general introduction to the field of Office Technology. A second text taught reading within the field of Office Technology, and a third text taught mathematics by doing the kinds of math tasks found in office jobs.

While there was still no way to tell exactly how long it would take for M. Lopez to raise her skills to the 9th grade level, it was explained to her that the program used a job-related reading assessment that would measure her improvement in both knowledge of office technology and in the basic reading and mathematics skills. Typically, this type of assessment indicates more rapid growth in skills than indicated by traditional, general basic skills tests. Since the job-related test scores could be translated into reading grade levels, this meant that learners could expect to reach the skill levels needed for job training sooner than they would using general basic skills tests.

For M. Lopez, the new program agreed with what she had in mind when she was enrolled in the JOBS program. Even though she was in a basic education program, she was already receiving the job-training that she wanted. She was learning about work in Office Technology occupations while improving her reading and mathematics skills. This would give her an extra edge when she qualified for and entered her occupational training. With this incentive, M. Lopez completed the basic skills program, enrolled in Office Technology training, and later became an office assistant in the Gibson Paper Company.

GOALS: A Functional Context Adult Reading Series

What the ABC'S Inc. discovered was that to overcome the mismatch between what vocationally-oriented learners want and what they are frequently offered in basic skills programs, there is a need for instruction that teaches the basic skills within the context of the vocational field in which the learners wish to study. In this approach, reading instruction is aimed at helping people enter the workforce by permitting them to gain access to needed vocational and technical training and to succeed better.

They can do this because by having available vocationally-related reading instruction, the basic skills program becomes an extension of the vocational education that they came for in the first place, and therefore they are motivated to continue in the basic skills course.

By learning reading while reading in the vocational content domain, learners develop a body of prior knowledge that will later help them read and comprehend better in the vocational education or technical training program of their choice, and they learn more generally useful strategies for using graphic tools (books,matrices, diagrams, flow charts) for performing *reading-to-do* and *reading-to-learn* tasks.

FCE Concept Note: Research in work-related basic skills has identified two major categories of reading that job trainees or employees perform. One of these, *reading-to-do* something occurs when a learner or employee is doing a task, such as filliing-in a purchase order. While doing the task, the person discovers that an order number is needed. So the number is looked-up in a catalog, logged onto the form, and the person can then forget the number.

The second major category of tasks are *reading-to-learn* tasks. In reading-to-learn, the person must read material and mentally process it so that it becomes part of the person's long term memory. For instance, in an Office Technology training program, the learner must read a chapter about the Office Assistant's job and learn the material for later use in job training.

In terms of the human cognitive system model discussed in chapter 4 (figure 4.1), reading-to-do tasks require that a person look-up information, hold it in ***working memory***, apply it , and then they can forget it Reading-to-learn tasks require that the person look-up information, hold it in working memory, perform additional mental processing of the information to store it in ***long term memory*** as a part of the person's ***knowledge base***, and then retrieve the information when it is needed in training or work situations. Clearly, reading-to-do and reading-to-learn require learners to develop different kinds of information processing skills.

The GOALS Program. As indicated in Figure 8.1, in the Glencoe Occupational Adult Learning Series (GOALS) there are five vocational content areas that provide the functional contexts within which reading abilities are developed.

Information Processing Skills For Reading	Vocational Knowledge Content Domains				
	Office Technology	Health Occupations	Automotive Trades	Construction Trades	Electricity & Electronics
Reading-to-do					
Locating Information In: Table of Contents Indexes Body of text Tables, Graphs, Figures Glossaries					
Reading-to-learn					
Before Reading Preview Question During Reading Read Represent Pictures Matrices Flow Charts After Reading Review					

Figure 8.1. The GOALS Functional Context Education Vocational Program.

Figure 8.1 makes the point that the information processing skills involved in reading-to-do and reading-to-learn are common to these six vocational areas. However, to improve reading comprehension in the vocational programs that people will study after the reading program, it is important that they deveop a knowledge base related to the vocational area. This perspective is consistent with the simple model of the human cognitive system shown in Figure 5.1 (Chapter 5) in which information processing skills in working memory operate upon the knowledge base in long term memory during the reading process. The implication of this model is strong: *for learners to read and comprehend well in any content area, they must possess extensive bodies of knowledge related to what is being read.*

The Design of the Knowledge Base Books to Facilitate Learning

In the design of the GOALS materials, for each vocational content area there are three books. One of these is a content textbook called the "knowledge base." The knowledge base (KB) presents a *coherent body of knowledge* about the vocational field in which the adult learner wishes to be educated and trained. The KB book is designed to facilitate learning. It begins with a double-spread of pages at the front of the book that contains a picture showing an overview of people at work in different positions in the vocational area.

For instance, as illustrated in Figure 8.2, the Office Technology knowledge base text shows a picture of a receptionist, people at work in a mail room, copy center, desktop publishing area and so forth. The picture is called a "memory icon" because in Jerome Bruner's theory of cognitive development, learners are said to progress from sensorimotor learning in an "enactive" mode, through a perceptual or "iconic" mode of learning to a linguistic or "symbolic" mode of learning.[1] The KB book follows this developmental sequence with learning begining in the iconic mode which provides a perceptual basis for developing a knowledge schema of the office positions and technical areas that will be discussed symbolically in the body of the text.

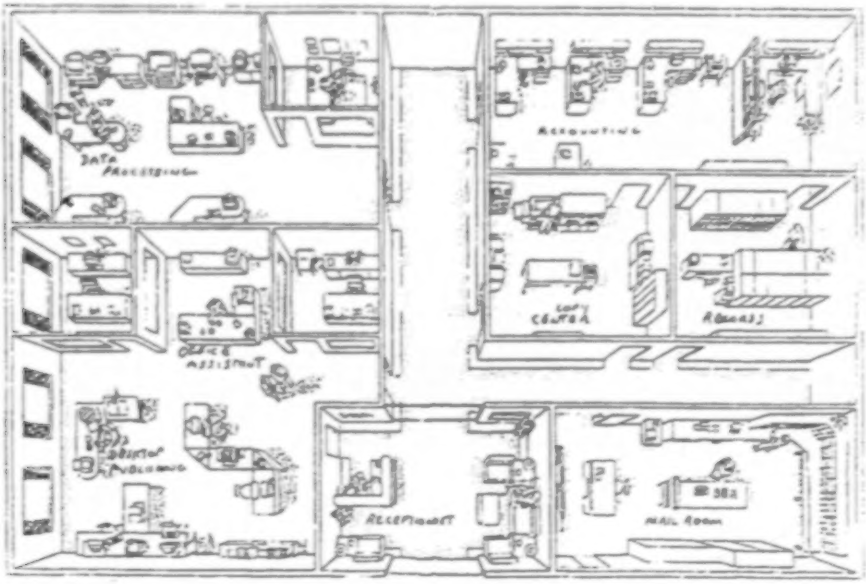


Figure 8.2. Office Icon from the GOALS Office Technology Knowledge Base.

BEST COPY AVAILABLE

Each KB book begins by asking the reader to look at and study the front picture. Then, the text takes the reader from one room to the next, introduces the reader to the person or people working there, and has the latter explain, in an overview, what they do in their job. This introduction uses story-like, dialogues and narrative text structures. Later, the text turns to expository structures. By proceeding from the iconic-perceptual, to story-narrative, and then expository text structures an attempt is made to follow a developmental sequence that will make it possible for the reader to construct an internal knowledge base that is organized in a retrievable (accessible) manner.

The Interactive Nature of the Knowledge Base and Information Processing Skills Books

The KB text is designed so that it may be used interactively with two information processing skills texts, one for reading and one for mathematics. This arrangement is modeled after the human cognitive system model of Figure 5.1 (Chapter 5) that shows information processing skills (IPS) in working memory working on knowledge in the long term memory (the knowledge base). In the GOALS materials, the reading IPS text is an external representation of the internal IPS of the cognitive model.

In use, the learner reads the IPS/Reading text and is asked to perform a number of reading-to-do and reading-to-learn tasks. Figure 8.1 summarizes a number of these tasks. To perform these tasks, the reader must consult the KB book. For instance, in teaching *reading-to-do* tasks, the IPS book asks for information to be located in the KB book using the table of contents. To make this task appropriate for mid-level literates (readers between the 5-9th grade levels) the table of contents of the KB has been constructed to be of sufficient complexity (up to four levels of subordination) to develop ability suitable to the reading of "real" tables of contents in vocational and technical training courses.

In *reading-to-learn*, the learner is taught the "active" reading strategy of information processing in terms of activities to do before reading, during reading, and after reading to facilitate comprehension and learning. This active reading strategy is used extensively to go beyond familiarity to mastery of the strategy. As mentioned above, this approach derives from the fact that the knowledge base text is based on the graphics technology feature of permanence, and it contains a store of information that must be specially processed (studied) to be learned.

As part of the "during" and "after" reading activities, the learner is asked to go to the knowledge base book and to extract from various locations information to construct a matrix (table) containing different pieces of equipment, their functions, advantages and disadvantages and so forth. This develops complex information searching and synthesizing in the classification mode of analysis identified by Upton.[2]

At other times, the learner is asked to read the IPS text, to locate information in the KB text, and to draw pictures, thereby exercising Upton's structural analysis skills in the context of reading vocational information.

At yet other times the IPS text requires the reader to find procedural text in the KB and to transform it into a flow chart representation, developing Upton's process, procedural or operations form of analysis that is characterized by steps of a procedure carried out over time.

FCE Concept Note: The active reading strategy used in reading-to-learn is based on several important concepts. First, it is based on the idea that learning from text requires an active process by the reader to **construct meaning** from a combination of (1) the prior knowledge that the learner has about the content to be read and (2) the information represented in the textbook. In the active reading strategy, **before reading**, the reader first previews the chapter to be read, looks at pictures, section headings, etc. and asks questions such as, "Do I know what a mail room clerk might do?" " I wonder what "routing" of mail means?" The purpose of these Preview and Question activities is to permit the reader to **mobilize prior knowledge** before reading the chapter. **During reading** of the chapter, the learner then performs a number of activities to **construct meaning** by recoding the information from the form of representation that the textbook uses, to another form that clarifies the information in the text. This may mean summarizing the main ideas, or drawing a picture of the content, or changing description of a procedure from an expository form to a flow chart. The purpose of these recoding or information representation activities is to help the learner relate the information in the text to prior knowledge. This is based on the idea that new knowledge is constructed by transforming and extending old knowledge through a process of transforming the way both the old and new knowledge is represented. Through this representation transformation, or recoding process, the learner integrates the new information into his or her prior knowledge base.

Finally, **after reading**, the learner reviews the material previously read to **reconstruct** the knowledge that was previously constructed. Through the PQ3R (Preview, Question, Read, Recode, Review) active reading processes, the learner constructs new knowledge of the content area and adds it to her or his prior knowledge base, which will be useful in studying further in the field or in performing on the job. Additionally, the learner acquires an information processing strategy and a number of skills for analyzing and representing information, such as illustrating, constructing tables of information, and flow charting. The latter are useful not only in comprehending more deeply what is read but as document design skills for communicating efficiently with others about what was read or designed through thought.

GOALS: A Functional Context Adult Mathematics Series

The approach to mathematics instruction in the GOALS series is similar to that used in reading instruction in that the Knowledge Base texts and the Mathematics IPS text are used interactively. The aim is to teach learners a body of knowledge about mathematics in the context of one of the occupational content areas.

The IPS Mathematics text teaches learners to perform three categories of occupational tasks identified in the SCANS work as being important for all learners to be able to perform across a wide variety of jobs: Mathematics and Financial Resources; Mathematics and Material Resources and Mathematics and Human Resources

Even if a learner does not work extensively with mathematics in entry level positions, these categories represent the types of tasks that employees would engage in as they progress in their occupational fields. By performing such tasks in the context of the occupational area represented by a given Knowledge Base text, learners not only learn how to apply mathematics to important occupational tasks, they also develop further knowledge about the career field.

The 3 C's: Comprehension, Computation, and Communication.

Research on occupational mathematics that required employees to read mathematics and knowledge base texts and perform mathematics tasks, found that many personnel were weak in reading comprehension strategies. They frequently failed in performing mathematics tasks more because of comprehension problems than because of lack of mathematics skills. Additionally, it was found that many did not know how to make notes about what they were reading in order to keep track of data extracted from tables, how to arrange the data to compute accurately, and how to communicate their computations in bar graphs and other types of figures. Based on the research studies, the GOALS mathematics instruction follows a "3 C's: approach that emphasizes *comprehension, computation,* and *communication* (Figure 8.3).

The Mathematics Knowledge Base.

The GOALS approach to mathematics instruction also involves the presentation of the *Mathematics Knowledge Base* for learners to study (Figure 8.3). This presentation is based on research in the military that indicated that learners frequently did not know what they knew about mathematics. That is, they had no organized way of referring to what they had learned in mathematics up to the ninth grade level or so. The Mathematics Knowledge Base figure helps the learners see at a glance what they know or must learn in the field of mathematics to perform the job-related mathematics tasks in their occupational field.

The Mathematics Knowledge Base figure shows that there is really not a great deal to learn about mathematics to be able to function quite well in most jobs. There are only five "chunks" of knowledge that must be mastered. Learners need to know how to perform the four operations using one of five types of numbers working with ten or so systems of measurement. It is important to note that, in a work setting or other "real world" setting outside of school, people rarely compute numbers for the fun of it. They almost always compute numbers with one of the measurement systems given in the Mathematics Knowledge Base. And they frequently have to use percentages, ratios, and proportions, which are numbers derived from relationships among numbers. Finally, they will have to know some simple statistical concepts such as averages, medians, range, and they will have to comprehend and present information in tables and graphs.

In use, the IPS/Mathematics text draws on materials from the KB text, such as a payroll ledger in the Office Technology KB, and provides instruction and practice in comprehending what the task is that the learner is to perform, how to do the computations involved, and, importantly, how to present the resulting data so that it communicates to the next user of the data.

An Emphasis on the Complexity of Information Processing in Work Settings

The interactive nature of the IPS and KB books means that the books had to be designed together to be usable together. This integrated design permits the different IPS activities such as transforming text to tables, pictures or flow charts, or performing the mathematics tasks for managing financial, material or human resources. To do this, there must be suitable material in the KB to permit the IPS book to instruct the learner in how to perform these complex tasks.

By developing this more complex, interactive system, a deliberate attempt was made to simulate the complexity of information processing identified in the National Assessment of Educational Progress (NAEP) study of literacy among America's young adults. That study concluded that "While the overwhelming majority of young adults adequately perform tasks at the lower levels on each of the three scales [prose, document,quantitative], sizable numbers appear unable to do well on tasks of moderate complexity (p.4)" [3]

The report goes on to state that "What these analyses suggest is that, in many instances, literacy tasks require individuals to apply complex information-processing skills and strategies. Some tasks require the reader to identify needed information, locate that information in a given source, remember it, combine it with additional information, and enter it onto a form or separate document (p. 65)."[3]

The 3 Cs

1. Comprehend

- o State what you are to do.
- o Decide on the steps you steps you should follow.
- o Collect the necessary information.
- o Decide what system of measurement to use.

2. Compute

- o Decide what computation to do. This involves deciding on the operation to do, the types of numbers you need to use, the system of measurement, and whether to use statistics, tables or graphs as part of the process.
- o Do the computation.

3. Communicate

- o Communicate the results to yourself and others in writing (completed forms; tables; graphs).

The Mathematics Knowledge Base

Basic Operations
Addition
Subtraction
Multiplication
Division

Types of Numbers
Whole Numbers
Fractions; Decimals
"Mixed"; Signed

Systems of Measures
Weight; Volume;Time;
Temperature;Money
U.S. Standard Measures;
Metric; Length;Area;

Statistics & Graphs
Count Distributions; Central
Tendency;Variability; Bar,
Line & Circle Graphs

Relationships Between Numbers
Percentages;Ratios;
Proportions

Figure 8.3. The GOALS Approach to Mathematics Instruction.

> **FCE Concept Note:** The Mathematics Knowledge Base figure is designed with five "chunks" of information to make the mathematics knowledge more learnable. Research in cognitive science has indicated that working memory can hold up to seven, plus or minus two "chunks" of information in familiar content without becoming overloaded. For instance, look at the following numbers briefly and then look up and repeat the numbers: 5, 9, 1, 3, 6 - look up! You could probably repeat the numbers without much trouble. Now try the next set of numbers: 8, 1, 9, 5, 2, 4, 6 - look up! This time you may have reversed a number or even forgot one and substituted another. This shows how working memory can be overloaded when more than five to seven "chunks" of information are involved.
>
> By placing all of the information in the Mathematics Knowledge Base into just five categories, the learner can learn the five category names and then learn the information under each category. This makes it easier to learn all of the information *and* it makes it more retrievable from the learner's knowledge base. Learners can retrieve information from their knowledge base easier when it is organized by categories, images, or other schemes.

In many basic skills materials, learners work only in a workbook in which they read a small segment of prose, or a simple table, form or other graphic device, and then answer one or more questions about the materials. In the KB and IPS texts approach the reader encounters tasks with information processing demands more like those needed for the "real world" tasks identified in the NAEP assessment and in the report of the Secretary of Labor's Commission on Achieving Necessary Skills (SCANS).[4]

Though the GOALS materials can be used in a self-study, learning center setting, they are best used in teacher-led classrooms that emphasize meaning-making and knowledge learning. The Knowledge Base books are authentic textbooks that offer many opportunities for teachers to model the use of textbooks, for creating semantic maps, for sustained silent reading, for reciprocal teaching, and other cooperative learning experiences.

References

[1]Bruner, J. (1968). *Processes of Cognitive Growth: Infancy.* Worcester, MA: Clark University Press.

[2]Upton, A. (1973). *Design for Thinking: A First Book in Semantics.* Palo Alto, CA: Pacific Books.

[3]Kirsch, I. & Jungeblut, A. (1986). *Literacy: Profiles of America's Young Adults.* Report No. 16-PL-02. Princeton, NJ: National Assessment of Educational Progress, Educational Testing Service.

[4] Secretary's Commission on the Achievement of Necessary Skills (SCANS). (1991, June). *What Work Requires of Schools: A SCANS Report for AMERICA 2000.* Washington, DC: U. S. Department of Labor.

Chapter 9

Functional Context Education Case Study #3: An Integrated Basic Skills and Electronic Technician's Course

Scenario: ABC'S Inc. redesigns its Electronics training program to integrate technical and basic skills training.

At the Gibson Paper Company, Carmen Lopez met Helen Jones. M. Jones worked in the copy center. There she made copies and occasionally performed maintenance and minor repairs on the photocopy equipment. She liked this kind of repair work. She talked with Carmen Lopez and told her about how she would like to get into electronics technician's training someday. M. Lopez told M. Jones about ABC'S Inc. and how it offered training in electronics work.

So one Monday that she had off, M. Jones went to ABC'S Inc. and talked with them about possibly getting into their Electronics training program. The in-take advisor asked M. Jones to take some basic skills tests. The Electronics program required 9th grade reading and mathematics skills for enrollment.

However, M. Jones scored at the 7th grade level in basic skills. She was given the option of entering the basic skills program, where she could study the GOALS materials for preparing people to enter Electronics technician's training. But M. Jones did not want to spend the extra time in the basic skills program. She told the ABC'S Inc. counselors that she would brush-up her basic skills on her own and come back someday.

Their experience with M. Jones lead the ABC'S Inc. staff to wonder why the Electronics program required 9th grade basic skills. After studying the program, they found that it was highly theoretical and abstract. The text for the course was written at the 11th grade level, and there was little emphasis upon learning in a developmental sequence from enactive, to iconic, to symbolic modes of learning.

The ABC'S Inc. staff decided to find out if there were other approaches to Electronics training that did not require such a high entry level of basic skills. Their search led them to a prototype Electronics course that had been developed in research sponsored by the Ford Foundation. The prototype course followed similar concepts and principles as used in the GOALS program. The difference was that the GOALS redesigned basic skills training and incorporated aspects of technical training into the basic skills course. What the Functional Context Education/ Electronics Technician's (FCE/ET) prototype course did was redesign technical training so learners with basic skills at the 5th grade or above could enter directly into technical training. In the context of the technical training, then, their basic reading and mathematics skills were developed.

The Functional Context Training/Electronics Technician's Course

This chapter describes the prototype Electronics Technician's course studied by ABC'S Inc. that was developed based on concepts from functional context theory.[1,2] The Functional Context Training/Electronics Technician's (FCT/ET) course was designed to help marginally prepared students to succeed in a full-scale Electronics Technology training program, one in which they might otherwise fail. The FCT/ET course attempts to facilitate learning in three ways.

First, it builds new knowledge on old knowledge by using familiar electrical devices to teach basic electronics principles and equipment analysis procedures.

Second, for each electrical device, the sequence of instruction proceeds from active manipulation of the device to see how it and its sub components function (enactive learning), to study and construction of illustrations or block diagrams of the device and/or its components (iconic learning), and then to the performance of reading and mathematics tasks involving knowledge of the device (symbolic learning).

Third, the content of individual lessons and the sequence of their presentation are explicitly constructed to permit students to transfer what they have learned to other training or job settings.

Design of the Course

The design of the FCT/ETs course followed the broad conceptual guidance of the model of a human cognitive system discussed in Chapter 5. According to that model, the human cognitive system contains a knowledge base that contains the person's accumulated knowledge of the world and how to operate in that world using the information available in it. The knowledge base contains a subset of knowledge called the information processing skills. These processing skills operate on information from the knowledge base and from "outside the head" in an active "working" or "short term" memory. Thus for people to learn, new knowledge must be integrated into old knowledge via the information processing skills.

The human cognitive system model was used heuristically to help the curriculum development team focus on the curriculum as a means of "designing the mind" of an electronic technician, rather than the traditional focus on teaching basic electricity and electronics. The latter focus tends to lead to abstract, decontextualized subject matter programs that may or may not provide the knowledge and skill actually required by an ET at work. The cognitive model continually focused attention on the question of what an ET must really know to learn and to do a job.

The curriculum operates under the assumption (and supporting research) that what makes someone a good technician is systematic knowledge about how electronic equipment works and of specialized procedures for diagnosing equipment failures, in addition to theoretical knowledge of electricity. The curriculum explicitly aims to develop "mental models" of equipment and analytic procedures for thinking about equipment in a systematic way.

The cognitive system model graphically illustrates the interrelationships, and indeed, the interdependencies of the so-called "basic skills" of reading and mathematics and other knowledge and processing skills typically thought to be technical knowledge that is independent of the knowledge needed to comprehend what is being read. This tendency to view content knowledge as separate from whatever it is that makes reading comprehension possible shows itself repeatedly in the existence of separate basic skills remedial courses that are supposed to prepare students with the "reading comprehension skills" that they will later need to read and comprehend the content course material.

The tendency to view knowledge as compartmentalized also shows itself in the basic skills courses where reading and mathematics are taught separately, even though the reading of mathematics texts and word problems poses many of the major problems in the learning of mathematics. In the present curriculum development, knowledge was viewed in an integrated manner.

Figure 9.1 illustrates how the FCT/ET course applies the concepts of a knowledge base with processing skills. The major materials of the course are a textbook called "An

Electronics Technician's Knowledge Base" and a student workbook called "An Electronics Technician's Information Processing Skills." These books were developed as external analogies of the cognitive system model of a long term memory (knowledge base) and working memory (information processing skills). Just as in the human cognitive system model information processing skills are applied to the internal knowledge base, in the instructional model, the information processing skills presented in one book are applied to the Electronic Technician's Knowledge Base text to transform the knowledge stored in the book to knowledge stored "in the head."

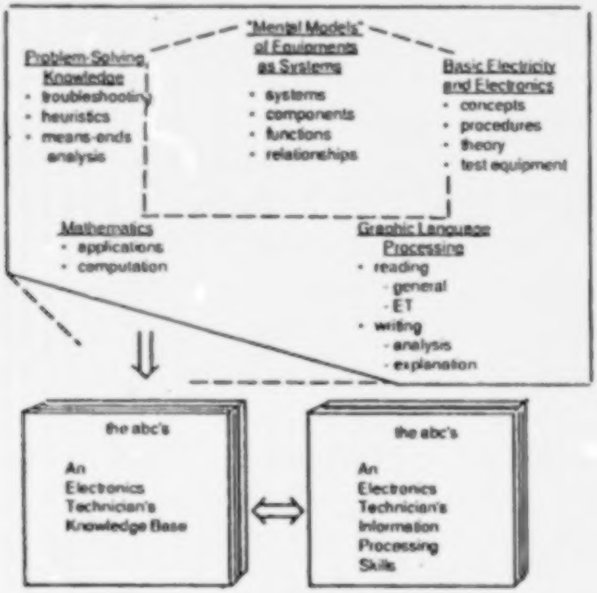

"Mental Models" of Equipments as Systems
- systems
- components
- functions
- relationships
Problem-Solving Knowledge
- troubleshooting
- heuristics
- means-ends analysis
Basic Electricity and Electronics
- concepts
- procedures
- theory
- test equipment
Mathematics
- applications
- computation
Graphic Language Processing
- reading
- general
- ET
- writing
- analysis
- explanation
the abc's
An Electronics Technician's Knowledge Base
the abc's
An Electronics Technician's Information Processing Skills

Figure 9.1. Knowledge base and information processing skills for the functional context electronics technician's course.

In the FCT/ET course, the ET's "mind" was construed as requiring knowledge in five domains: problem solving, "mental models," basic electricity and electronics (BE&E), language and mathematics (all, of course, interrelated with other "world knowledge" not explicitly addressed in the course). Large parts of this knowledge were "packaged" in the ET's Knowledge Base volume. Additionally, information processing activities involving reading, writing, and mathematics were included in the ET's Information Processing volume. In use, students apply the Information Processing skills to the ET's Knowledge Base both to learn the knowledge and to improve their processing skills. These text-based activities are supplemented by instructor lectures and demonstrations, and hands-on laboratory work using various common-place electrical devices.The general content and sequencing of instruction in the FCT/ET course are summarized in Figure 9.2.

To facilitate entry learning and build a meaningful and motivating basis for in-course learning, learners at entry are given information about various jobs and additional training for ET's that they may wish to consider after the program. This is followed by an overview of the course which emphasizes the ET's role in operating, maintaining, and repairing equipment. Learners are told that in the FCT/ET course they will learn how to think about equipment in a systematic way, and that they will learn this way of thinking using common, everyday electrical devices that they most likely have used in their day-to-

BEST COPY AVAILABLE

day lives: a flashlight, table lamp, curling iron, and AC adapter used with portable radios and tape players to recharge or replace their batteries. The pieces of equipment were selected both for their familiarity to females as well as males, and for their usefulness in introducing BE&E concepts and procedures.

By thinking ahead about what problems less literate students might encounter on entry into the course, the contents and sequence of the FCT/ET course were planned to proceed from the concrete to the abstract, from the specific to the general, from practice to theory, and from the familiar to the unfamiliar. This is accomplished using direct, expository prose in the ET's Knowledge Base text, avoiding analogies and metaphors that might require additional knowledge beyond that possessed by many students and not provided in the course.

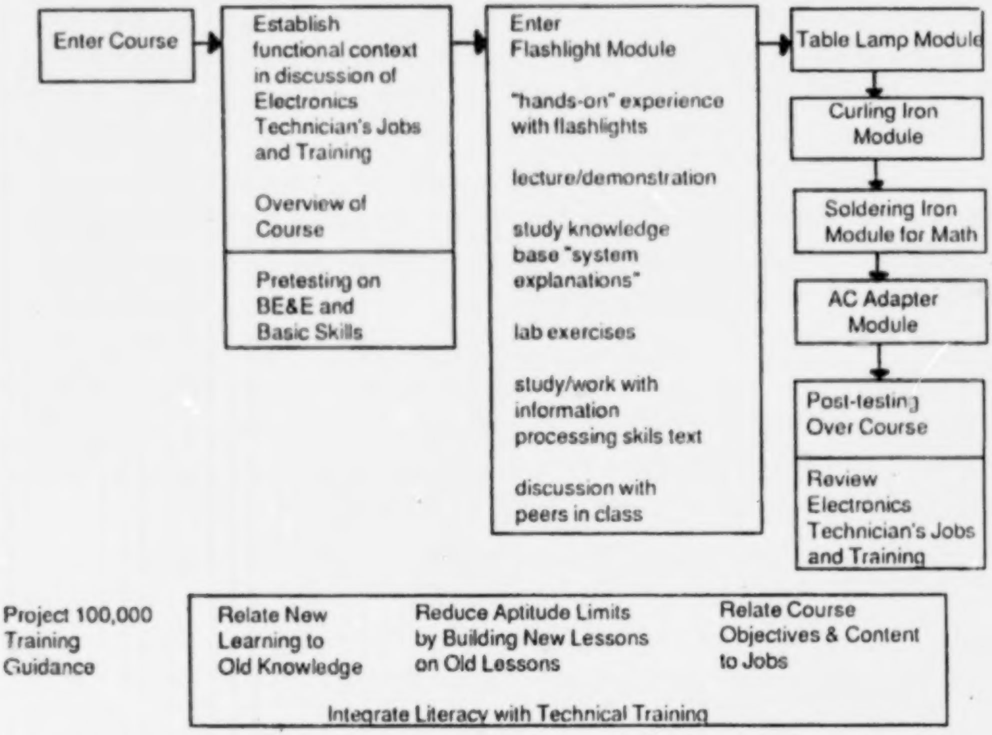
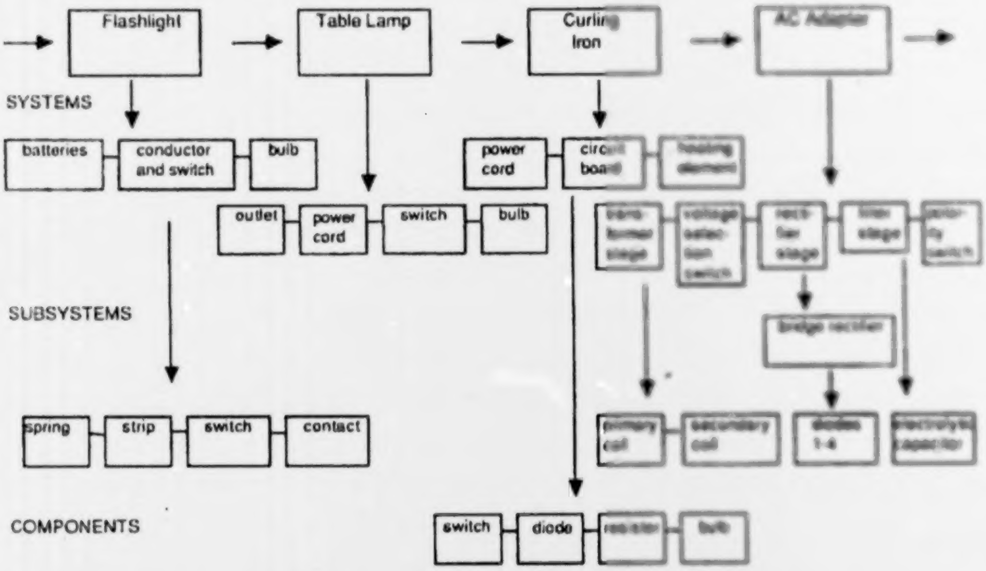

Enter Course
Establish functional context in discussion of Electronics Technician's Jobs and Training
Overview of Course
Pretesting on BE&E and Basic Skills
Enter Flashlight Module
"hands-on" experience with flashlights
lecture/demonstration
study knowledge base "system explanations"
lab exercises
study/work with information processing skils text
discussion with peers in class
Table Lamp Module
Curling Iron Module
Soldering Iron Module for Math
AC Adapter Module
Post-testing Over Course
Review Electronics Technician's Jobs and Training
Project 100,000 Training Guidance
Relate New Learning to Old Knowledge
Reduce Aptitude Limits by Building New Lessons on Old Lessons
Relate Course Objectives & Content to Jobs
Integrate Literacy with Technical Training

Figure 9.2. Content and sequence of instruction in the functional context electronics technician's course.

Proceeding through the course, lessons are sequenced *within* and *across* each module to build on and extend the student's knowledge base. Each module introduces a new electrical device or "equipment." The students are first given the opportunity to uncover and use whatever system understanding they already possess in attempting to troubleshoot devices that have been intentionally-faulted. To build "mental models" of equipment, students explore the devices in a "hands-on" fashion, then they listen to a lecture and watch a demonstration and work along with the instructor to learn how to examine and think about the piece of equipment as a "system" with specific inputs and outputs. Students are taught that each system includes separate subsystems, each with its own function. The subsystems contribute to the function of the whole system and all subsystems must function for the total system to function. Each subsystem may contain one or more individual *circuits* upon which the subsystem's function depends. Finally, the circuits (or subsystems) are made up of individual *components* collectively, and at all levels of complexity, the parts of a system are referred to as the elements of the system.

To diagnose and repair a malfunctioning system efficiently, students must understand the function of each of the system's elements, and the interaction among elements. This understanding is used to generate hypotheses about the location of problems. By testing each of the hypotheses, it is possible to isolate the failing element causing the malfunction. Usually, a number of means can be used to find a faulty element and verify that it is the source of the system's malfunction. Since the appropriateness of a test depends on the situation and upon the type of malfunction, analysis of the four devices is employed as a way of demonstrating to students how to isolate and repair a range of possible faults.

Figure 9.3 illustrates the analysis of devices from the system level, through subsystems, circuits, and components.The curriculum proceeds "downward" through each system. A decomposition that simulates the troubleshooting activity of expert. For didactic purposes, lessons require students to consider all of the possibilities for hypothesis generation and fault isolation for each system is pursued to the level at which an element is replaced or repaired. Once the student has completely decomposed a system, he or she is ready to move on to the next system. This general sequence is called "whole-to-part" because it starts at the level of a whole system and proceeds to its parts.



Flashlight
Table Lamp
Curling Iron
AC Adapter
SYSTEMS
batteries
conductor and switch
bulb
power cord
circuit board
heating element
outlet
power cord
switch
bulb
transformer stage
voltage selection switch
rectifier stage
filter stage
polarity switch
SUBSYSTEMS
bridge rectifier
spring
strip
switch
contact
primary coil
secondary coil
diodes 1-4
electrolytic capacitor
COMPONENTS
switch
diode
resistor
bulb

Figure 9.3. The "whole-to-part" systems analysis of electrical devices.

Instructions for analyzing each electrical device are given in the ET's Knowledge Base text. The instructions for each equipment are presented in a module called a "System Explanation." Each System Explanation is essentially a text-based "narrative" with the troubleshooting of an electrical system as its "plot." Its diagrams, text, and illustrations together constitute a description of how to diagnose and repair a target system. As new elements of the system are introduced, students learn new concepts and skills needed to understand and test new functions, and to replace faulty elements. Through the medium of System Explanations, course content progresses in complexity from the level of the whole system down to the level of the components.

BEST COPY AVAILABLE

Block diagrams illustrate the functions of each of the system's elements at the different levels. Figure 9.4 shows the functional block diagram of the curling iron. The top level of the curling iron diagram shows the function of the whole system; the input is electric current, the output is high or low heat, depending on the switch setting. The top level of the curling iron diagram shows the function of the whole system; the input is electric current, the output is high or low heat, depending on the switch setting. The top, or "system" level of the block diagram represents explicitly the basic knowledge one has implicitly when *using* the device. This is the implicit knowledge that most students already have (which is drawn on to begin the more formal learning of a systems way of thinking about equipment, as is needed by the competent electronics technician). The second level of the System Explanation, which corresponds to the second level of the block diagram, describes the function and testing of the three subsystems (the power cord, the circuit board, and the heating element). The third level covers the function and testing of each of the circuit board's components.

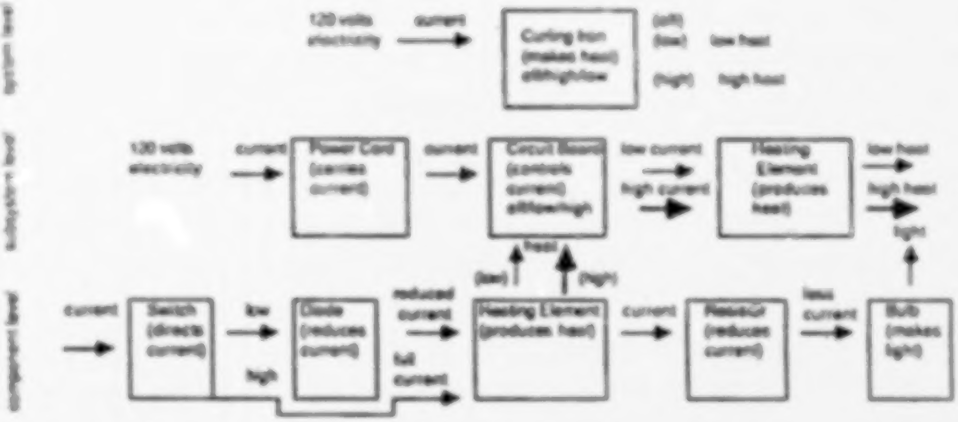

system level
120 volts electricity
current
Curling Iron (makes heat) off/high/low
(off)
(low)
low heat
(high)
high heat
subsystem level
120 volts electricity
current
Power Cord (carries current)
current
Circuit Board (controls current) off/low/high
low current
high current
Heating Element (produces heat)
low heat
high heat
light
heat
(low)
(high)
component level
current
Switch (directs current)
low
high
Diode (reduces current)
reduced current
full current
Heating Element (produces heat)
current
Resistor (reduces current)
less current
Bulb (makes light)

Figure 9.4. A symbolic representation of the systems and subsystems of the curling iron using functional context block diagrams.

Each level presents only the knowledge needed to test functions at that level. Each level is a "black box," a problem presented solely in terms of input and output. The presentation of a hypothetical need to locate a fault inside a "black box" creates a functional learning context. For example, it was assumed (see below) that most students' knowledge of a curling iron does not extend beyond the system level, the user's knowledge of the device. Hypothetical malfunctions of the curling iron provide a framework — a useful pretext — for explaining the function and testing of each of the curling irons subsystems. This means of presenting the information eliminates much of the content that is extraneous to the task of repairing electrical devices and so it simplifies and shortens instruction. For example, there is no functional reason to explain the details of the composition of the resistor, since it is simply replaced rather than repaired.

BEST COPY AVAILABLE

The block diagrams make it possible to differentiate physical outputs, such as heat and electricity, and controls, such as switches and dials. Since the learners are expected to have little technical knowledge of electricity and electronics, conventional schematic diagrams are inappropriate for conveying new concepts. When a schematic is needed to further explain the circuit that makes up the curling iron's circuit board, a schematic diagram and instructions for reading it are introduced with a corresponding block diagram. Additionally, most of the elements and many of the procedures described in the System Explanations are illustrated with line drawings.

Integrated Basic Skills Instruction

In developing the FCT/ET course, reading, writing, diagramming, problem solving, and troubleshooting instruction were integrated with the technical knowledge development. As mentioned earlier, in the cognitive system model, reading, mathematics, and other cognitive capabilities are not thought of as separate abilities to be taught prior to and with materials primarily external to electronics. Rather, in keeping with the cognitive system model, in which cognitive development proceeds by building new knowledge on old knowledge, the basic cognitive skills instruction takes advantage of what students are learning about BE&E, and the BE&E instruction takes advantage of the student's increasing knowledge of mathematics and strategies for learning by reading.

This "integration" of literacy and mathematics training serves several purposes. First, by teaching basic skills within the context of technical course content, students can understand the functional utility of reading and mathematics concepts. Hence, they are motivated to increase both their technical skills and their literacy and math skills. Just as technical topics are connected with student's prior knowledge, literacy and math skills are connected with something students already know about. Second, the presentation of technical and basic skills instruction together eliminates the need for remedial courses students might need to take before receiving technical instruction. Combining the two types of training shortens total training time. This is of special importance for out of school youth and adults because it permits them to move out into the labor market sooner, and it gives learners less time to get frustrated and drop out of training.

Literacy Skills

Developing the literacy competence needed to perform a wide range of job-related reading tasks is crucial to improving a student's long-term employability. Performing the exercises in the Information Processing Skills volume teaches the basic literacy skills the students need in order to read training and job-related material. These exercises guide the students processing of information contained in the Knowledge Base book. Simple worksheets provide explanations of and practice in performing reading-to-do and reading-to-learn tasks.

Reading-to-do tasks involve looking up information and remembering it only long enough to apply it, such as looking up repair specifications in a technical manual. Reading-to-do skills are used to extract information from documents and include using tables of content, indexes, and glossaries, and searching or scanning bodies of text, and tables and graphs, in order to locate needed information.

Reading-to-learn tasks involve reading information and storing it for a long term in the knowledge base for later use, such a studying for a test or learning about a piece of equipment. The specific reading-to-learn skills include re-reading something until it is understood, asking oneself questions about the material, transformation of information read by paraphrasing, block diagramming, or pictorializing the information, and focusing attention for rereading by highlighting, underlining or summarizing the information. These are the types of activities reading specialists usually teach to improve reading comprehension and learning by studying texts.

Applying functional context principles to literacy training suggests that material written on a topic about which the student has developed some prior knowledge will be read and understood better. Although the literacy instruction is focused on BE&E, many of the concepts and skills they acquire are applicable in a wide range of situations. For example, one of the exercises has students look up component specifications in a reference book to find information needed to replace components in the systems they are repairing. While the information they are retrieving is related to electronics, the "look-up skills" generalize to other types of reference materials.

Reading comprehension in the electronics area is further facilitated by the overall design of the course that begins with concrete objects (flashlights, etc.) and knowledge that the learners possess. Reading builds on this prior knowledge to permit the further development of the learners knowledge base in the electronics technology domain. According to the human cognitive system model, reading comprehension in a given topic area can be improved by increasing one's knowledge base in that area. By coupling this improvement in domain-specific knowledge with instruction in the general strategies for reading-to-do and reading-to-learn, learners develop more generally useful literacy skills and hence, their overall employability is improved.

Mathematics Skills

The process of troubleshooting electrical devices generates the need for mathematics knowledge. Using the multimeter to test flashlight batteries requires an understanding of fractions in order to read the scale and an understanding of decimal numbering in order to adjust scale readings. Reading the frequency and amplitude of a wave form on the oscilloscope screen calls for a solid grasp of many mathematical concepts, including scientific notation. In general, the System Explanations in the ET's Knowledge Base introduce mathematical concepts and their application, whereas learners get practice using the skills from the worksheets in the Information Processing Skills book.

A separate lesson, the Soldering Iron System Explanation, was developed to help learners over what appears to be a major hurdle in BE&E training. In needs assessment interviews, instructors noted that many students have difficulty understanding Ohm's Law and the applications of its associated math skills. The law governs the relationship between the resistance, voltage, amperage, and power values in a circuit; its application calls for understanding Ohm's Law and the applications of its associated math skills. The law governs the relationship between the resistance, voltage, amperage, and power values in a circuit; its application calls for understanding basic algebra concepts. Understanding of the concepts and ability to apply them to circuit problems is necessary in order to complete any conventional curriculum and to function in most job-settings.

Instructors cited student's difficulty with this type of electronics content as justification for the rather high level (high school algebra) of math skills that are prerequisite for entry into most BE&E programs. Examination of several conventional curricula revealed that Ohm's Law is usually introduced in an abstract fashion using schematics of contrived circuits, symbolic representations of circuit values, and an assumption of extensive mathematics knowledge.

The Soldering Iron Explanation introduces Ohm's Law by showing how to calculate a soldering iron's wattage rating. While it gradually introduces the mathematics of

Ohm's Law, the lesson introduces the abstract representations of circuitry that are a source of confusion for students in conventional courses. The lesson is introduced with a hypothetical job-related problem: "What would you do if you faced a task that called for a soldering iron of a specific wattage rating, and your iron's rating was not identified?" The instructor then demonstrates how, after measuring the resistance in the iron's circuit with the multimeter, one can determine first amperage and then power using Ohm's Law and a few simple calculations. In the iron and test instruments, and the same calculation is shown again.

A gradual progression from concrete to abstract representations as more and more complex calculations are presented allows each part of the lesson to provide a functional context for the introduction of each subsequent increasingly abstract representation. Schematic drawings are gradually substituted for pictorial representation of the process; the full names of the values (resistance, current, voltage & power) are eventually replaced with their standard symbols (R, I, V, & P); and the value units of measurement (ohms, amps, volts & watts) are replaced with their abbreviations (O, A, V, & W). At the end of the lesson, students are working Ohm's Law math equations using the same abstract representations with which many conventional curricula start teaching this content.

One of the main concerns addressed by the math instruction is maintaining the overall organizing schema created by the functional electronics problem-solving context. The Soldering Iron lesson attempts to maintain this schema by keeping the learners aware of when they are learning BE&E principles, applications of math skills, or learning basic math skills. To this end, the module recognizes three levels of ability and provides three different types of instruction regarding each math skill presented:

- Level One learners can understand the math skill and its application as it is described in the System Explanation and do not need any additional help.

- Level Two learners may need some brushing up on the math skill and have difficulty applying it to the BE&E problems. Markers embedded in the text of the System Explanation refer the reader to Helps placed at the bottom of the page that provide more detailed explanation of the math skill and its application, still within the context of the BE&E problem.

- Level Three learners need more instruction than is provided by the Helps, and may have never learned the math skill. These learners are directed at the end of the Helps to turn to the appropriate math worksheets at the back of the Explanation that give detailed decontextualized explanation and practice of the basic math skill. Once the learner has mastered the skill, he or she can use the Helps and the System Explanation to master applying the skill and the BE&E principles involved.

The Soldering Iron lesson is oriented to learners whose general math ability is not far below the second level. Level two learners should be able to skip some of the Helps but also need some of the supplemental worksheets. For level three learners, peer tutoring coupled with practice on the detailed math explanations and exercises are used.

FCE Concept Note. An actual operational course like the FCT/ET course described above has never been fully implemented and evaluated. However, an early version of the Knowledge Base and some components of the Information Processing Skills text were used in a pilot test to obtain data about the feasibility of an integrated basic skills and BE&E curriculum and to obtain information upon which to base revisions and further development of the curriculum. At the time of the pilot testing, the experimental curriculum consisted of four System explanations and a set of worksheets; the Soldering Iron Module was tried out in rough form.

The pilot testing suggested that it is indeed feasible to integrate basic skills instruction into technical skills training. Although there were some minor logistical problems, it was possible to deliver the course as it had been constructed. The electrical devices (flashlight, etc.), as it turned out, had been chosen well. The reaction of students and teachers to the course and its content was, in the main, positive. The students and the instructor experienced some difficulty, at times, with the form of certain worksheets and quizzes, but overall, students appeared to understand the System Explanations and to profit from the worksheets, quizzes and other supporting materials. With minor qualifications, the curriculum appeared to work well as it stood.

One of the main objectives for the pilot study was to determine whether or not the reading difficulty of the System Explanations was too high. Based on the students' abilities to answer questions on the quizzes, and instructors' observations, the students were able to understand the contents of the System Explanations with only moderate difficulty. The implication here is that the Explanations should provide challenging reading for the lower-ability readers (5th through 9th grade levels) for whom they were intended, and hence contribute to further development of their reading skills.

All of the students were at least somewhat familiar with each of the four pieces of equipment described in the System Explanations. The students' guesses as to the possible problems in malfunctioning systems indicated that they knew how each device worked, but they did not understand it well enough to be sure of their answers. For example, most students recognized that only one heat setting operating on the curling iron indicates a fault different from the one indicated by neither heat setting working, but they were unable to analyze the differences beyond that level. That the students understood the difference between the malfunctions suggested, however, that they had some knowledge of curling irons and of what it means to say that one does not work. It is reasonable, therefore, to use a curling iron to create functional contexts for teaching electrical repair. Similar observations held for the other pieces of equipment.

While formal data gathering was out of the scope of this partial tryout, there was clear evidence that the students were learning both BE&E and basic skills. The students were able to answer quiz questions correctly and they demonstrated the skills covered. All of the students were able to use the multimeter to measure voltage and resistance values. Although such observational data provide the same basis for evaluating student learning as is used in many training evaluations, it is clear that the development of pre- and post-tests for evaluating the overall effectiveness of learning in the course would be desirable if a complete FCT/ET course were to be developed and evaluated.

References

[1]Sticht, T. & Hickey, D. (1991). Functional context theory, literacy, and electronics training. In: Dillon, R. & Pellegrino, J. (Eds.). *Instruction: Theoretical and Applied Perspectives*. New York: Praeger Publishers.

[2]Sticht, T., Armstrong, W., Hickey, D. & Caylor, J. (1987). *Cast-off Youth: Policy and Training Methods from the Military Experience*. New York: Praeger Publishers.

Chapter 10

Functional Context Education Case Study #4: An Intergenerational Literacy Parenting Program

Scenario: ABC"S Inc., Inc. develops a program to improve women's reading skills in the context of parenting education.

In the Fall of 1991, the Director of ABC'S, Inc. was reading the Fall/Winter 1991 issue of *Women at Work*, the newsletter of the National Commission on Working Women and the Women's Work Force Network (WWFN). A front page story reported a study by the Wider Opportunities for Women (WOW) organization. The story reported that data had been obtained from nine member programs of the WWFN (which ABC'S Inc. also belonged to) showing that both the women in WWFN programs and their children benefited from the mother's participation in WWFN programs. In fact, 65 percent of the children of mothers in the WWFN adult education and job training programs were reported by parents and/or teachers to have made educational improvements as a result of their mother's participation in the WWFN programs.

An important aspect of the WOW study was that the mother's children showed educational improvements even though the WWFN programs involved had not set out to do anything other than educate the mothers. While some programs emphasized to mothers the importance of their being involved with their children's education, there were no systematic programs designed to have the mother's educational achievements transfer to benefit their children's educational achievements.

When the Director of ABC'S Inc. brought the WOW study to the attention of staff, there was enthusiasm for developing programs that would increase the intergenerational transfer of literacy and math skills from mothers to their children. One staff member recalled that the Barbara Bush Foundation for Family Literacy provided funding for programs that improved both mother's and their children's literacy.

Another noted that the new Public Law 102-73, which was signed by the President in July of 1991, increased funding for family literacy in the Even Start program from $15 million to $100 million. Furthermore, the Head Start program, with funding of some $4 billion was moving more and more to incorporate the education of both parents and children.

With this growing interest in family literacy, ABC'S Inc. staff decided that it was likely that ABC'S Inc. could get some funding to develop a program that would build on the intergenerational transfer of education from mothers to their children that presently occurs in WWFN programs, and enhance such transfer. As a first step, the ABC'S Inc. staff decided to use the methods of the WOW research project to develop a low-cost, learner-centered, participatory approach to the intergenerational transfer of literacy from mothers to children. With such a program in place, it could be pointed to as a first commitment by ABC'S Inc. to family literacy. This would be useful in writing proposals seeking funding.

ABC'S Learner-Centered, Participatory Literacy and Parenting Program

ABC'S Inc. staff noticed that, in conducting its research on the intergenerational transfer of literacy, WOW conducted a review of research on the effects of parent's education on their children's cognitive development and educational achievement. They found that the most important factor that produced high levels of educational achievement was the number of years of school the child completed. However, the next most important factor in the child's pre-school cognitive growth and later success in school was the parent's, and especially the mother's level of education (see chapter 1 for references to the research discussed here).

Essentially, a cycle was discovered. Adults who are educated have more influence on their children's' primary education. Completing the cycle, if education for children is successful, the result will be more highly literate adults who will, in turn, produce more highly educable children with whom the primary schools may work. Educating adults may be the leverage point in influencing this cycle in an upward direction.

By and large, research has indicated that literacy will be found in greatest abundance where there are literates who make wide use of their literacy. Thus, it is typical to find that the homes and communities of literates are likely to contain more literacy artifacts, such as signs, books, magazines, pencils, typewriters, writing paper, and so forth, than the homes and communities of non-literates or literates who make only restricted use of their literacy. In the homes where there are literate parents who use their literacy extensively, infants born into such richly nourishing cultures of literacy tend to grow literate to a large extent even before they enter into a special environment for cultivating literacy (primary school).

Also, parents with higher education have children who persist in school longer and achieve better than children whose parents, and especially the mother, have low levels of education. Furthermore, *parental involvement* is a key factor in pre-school experimental programs, Head Start, and compensatory schooling, and much of the success of these programs has been attributed to this involvement.

However, while parent involvement is a key feature of most early intervention programs, the programs do not typically focus on improving the parent's education level or intellectual cognitive abilities. While parents may be taught certain "parenting" knowledge, such as health care, how to stimulate the cognitive abilities of their children, and so forth, the programs do not, for the most part, aim at improving parent's literacy, mathematics, and other intellectual abilities.

A Developmental Perspective on the Effects of Mother's Education on Children's Education

Research reviewed by the WOW staff indicated that mother's educational level has effects on their children's cognitive skills and school achievement from before birth through college. These studies follow the developmental sequence summarized in Figure 10.1. These studies first show the effects of mother's education on fertility rates, then on the pre-and postnatal factors that prepare children for primary education, and then on the factors that help children remain in school and achieve well.

For each of the phases of childbearing indicated in Figure 10.1, there is a brief summary of the effects that mother's education level has on parenting in that phase. Additionally, the third column in Figure 10.1 suggests topics that might be included in a parenting program that addresses each of the four phases of parenting. Both the phases of parenting and the topics for a parenting program are elaborated on following Figure 10.1.

Before Pregnancy

The more highly educated a teenage girl, the less likely she is to become pregnant. Conversely, if a teenage girl avoids pregnancy, the more likely she is to complete secondary school, and the more likely that she will stimulate the cognitive and educational achievement of her children to higher levels. This cyclical, intergenerational consequence of teen pregnancy is an important factor in educating parents of teenage girls and boys about the importance of postponing child making until both have achieved higher levels of education.

The number of children born to an individual mother has an influence on cognitive development. It has been shown that the highest cognitive achievement results for those children born first. Relationships of family size to cognitive development in early childhood indicate that, on average, later children tend to develop less well than first borns. Hence, one consequence of increasing female education may be to reduce fertility thereby increasing average preschool cognitive ability in families having fewer children.

During Pregnancy and At Birth

Mother's education is associated with the prenatal and postnatal health of children. In the United States, it has been found that poorly educated mothers are more likely to suffer malnutrition, to smoke, and to abuse alcohol and drugs during pregnancy than more highly educated parents. Closely associated with these adverse activities are low birthweight and prematurity of birth of babies.

Premature, low birthweight babies are almost forty times as likely to die in their first month of life as normal term and weight infants. Additionally, low-birthweight babies tend to have learning disability rates 40 to 45 percent higher than normal weight babies, and they show high rates of language and literacy development problems.

Intrauterine Learning. Research also shows that before babies are born, they can learn while in the womb. They can respond to sounds conducted through the skin of the abdomen and the fluids of the womb. They can be startled by jarring movements and loud, raucous sounds. Because the ears and hearing mechanisms are omnidirectional, the sounds impinge upon the preborn without the child having to pay attention. However, studies have shown that preborns can learn to associate a sound with a forthcoming jarring movement of the mother's abdomen. Thus when the sound occurs, the preborn exhibits agitated movements suggesting anticipation of the forthcoming jarring movement. This intrauterine learning helps the preborn develop early memory and attention processes for learning and cognitive development after birth. In particular, the preborn and newborn infants are predisposed to listen to sounds and to acquire language.

Before Going To School

Studies have shown that mother's education is related to children's preschool nutrition and health, and with increased survival rates of children. Additionally, mothers exert a strong influence on children's cognitive and language development. Preschool cognitive development has strong effects on achievement in academic skills in schools, and these effects may persist into adulthood. For all ethnic groups, mother's education is a strong predictor of educational achievement. Across a wide variety of content areas, such as science, electronics, mathematics, automotive and shop knowledge, and others, mother's education is strongly related to young adult's performance on tests of knowledge in these areas.

Phase of Parenthood and Schooling	Effects of Higher Levels Of Mother's Education	Important Topics for Parenting Program
Before pregnancy	Higher economic productivity; better personal health care; lower fertility rates; smaller families.	Teenage pregnancy and the importance of education; family planning.
During pregnancy and at birth.	Better prenatal health care; more full-term births; higher birthweight babies; fewer learning disabilities.	Prenatal care; drug, alcohol, and tobacco use effects on fetus; intrauterine learning and cognitive development.
Before going to school	Better health care; better develop-ment of language, cognitive, and literacy skills; better preparation for schoolwork.	Health; nutrition; safety; mother and infant interaction; learning from visits to community locations (zoos, stores; churches;parks;office buildings; mother's education and training programs; work-sites; shopping malls; theaters; schools;etc.); language and literacy development; playing school and other socialization activities.
During the school years	Greater success in the primary grades; fewer placements in special education; better manage-ment of homework; better advocacy for children's education and negotiation of school and children's conflicts; higher academic achievement by children; more participation in schooling and better high school completion rates.	The nature of schooling; importance of taking part in school activities; talking with teachers; talking with child about school, looking at children's schoolwork; reading school notes, schedules, and report cards; communicating with school personnel; managing homework and extracurricular activities; motivating children to achieve well, stay in, complete school; sexual development and behavior of adolescents; peer influences on children.

Figure 10.1. Phases of parenthood and schooling, effects of higher levels of mother's education at each phase, and topics for parenting programs to increase the intergenerational transfer of mother's education to children.

Preschool Literacy Development

Parent's, and especially mother's education has a strong influence on whether or not children will have preschool experiences in literacy activities (scribbling, writing, being read to, reading picture books, discussing content) Children from more highly educated backgrounds enter school with higher levels of oral language skills. These children go on to become the higher level readers in grade school.

During the School Years

The work of the educated mother to develop cognitive and language skills of preschool children provides an advantage to children upon entry into school. But the influence of parent's, and especially mother's education level does not end there. In fact, a well-educated mother is a form of continuous support for children's educational success.

More highly educated parents know more about their child's school performance,about the schools and the schooling process, have more contact with the teachers, more often help their children negotiate the many demands of schools and are more likely to take action to manage their children's academic achievement.

Topics For Developing Parenting Programs as Functional Contexts for Improving Mother's Literacy Skills

Figure 10.1 presents topics developed by ABC'S Inc. staff that correspond to each of the effects that mother's education has in the four phases of parenting. The goal for an intergenerational, functional context literacy program is to develop a program that uses the parenting topics as content and develops methods for improving the mother's literacy skills while mastering the parenting content.

A Learner-Centered, Participatory Method for Developing a Parenting Program. One of the findings of the WOW intergenerational literacy research project was that mothers involved in the research program spontaneously became interested in their effects upon their children's education (see chapter 1). The mothers who participated in filling-out questionnaires read sections asking questions about how often they read to their children, how often they participated in school activities, etc.While doing this, many expressed surprised to learn that they could be doing things to improve their children's pre-school and in-school learning and achievement.

Members of the WWFN reported that many mothers began coming up with ideas for how they could become better teachers for their children. This suggested to ABC'S Inc. that a low-cost approach to the development of a parenting program would involve the mothers in their education and training courses to reflect on the ideas presented in Figure 10.1 and to develop their own ideas about how they might improve their own literacy, mathematics and other skills while also learning more about and going about helping their children learn more.

ABC'S Inc. could provide resources, such as guidance in using libraries and bookstores for finding useful resource materials. They could also invite specialists from universities and family literacy programs to speak to their clients. Cameras for making picture books, paper for drawing sketches and for children to "scribble-write" or to print and write on could be provided by ABC'S Inc. But the mothers themselves could develop the materials that they would use to interact with their children and their children's schools.

By using this learner-centered, participatory approach, an intergenerational literacy program can be developed inexpensively. Of course, such programs can also be developed that focus on the role of the father in bringing up children.

By engaging in the education of parents, we increase the educability of children. This is just one of the reasons we need to find ways to reach a larger number of youth and adults with functional context education.

Father's Education Is Related to Adult Children's Literacy Practices, Knowledge and Vocabulary

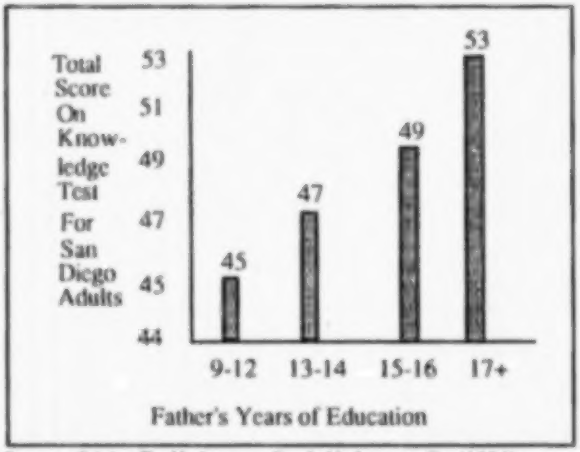
In an innovative telephone interview researchers in San Diego assessed area resident's literacy and vocabulary knowledge.

Using a random dialing method that produced a sample closely resembling the U. S. Census population, over 530 San Diego area, English-speaking adults, aged 18 years and above, were asked about their knowledge of famous authors, magazines, people, and vocabulary words.

In the Author Recognition Test (ART) , adults were told, " I am going to read you a list of people's names, some of these are the names of famous authors, and some are not. If you think the person is a famous author just say yes." For the ART, 10 actual author's names and 5 foil names were used. Foils, or false author's names, were used to correct people's responses for guessing. A similar approach was used for magazines, famous people, and vocabulary words.

Among the many interesting results of the survey were the findings that about 80% of San Diegans knew of the author Sidney Sheldon, but only about 40% knew Bob Woodward. This might be because Sheldon's works have appeared a lot on television.

Some 80% of San Diegans knew about Esquire and Forbes magazines, while only about half knew of Scientific American. Over 80% knew of Greta Garbo, Harry Houdini and George Gershwin, but fewer than a third knew of Margaret Sanger, Enrico Fermi or Carlos Fuentes. Only about a half knew of Rosa Parks. While over 80% knew vocabulary words of audible, optimize, and polarity, fewer than half knew that confluence, eventuate and purview were words.



Source: Sticht, T., Hofstetter, C. & Hofstetter, C. (1996). Assessing Adult Literacy by Telephone. Journal of Literacy Research, 28, 525-559.

The intergenerational effects of parent's education on their adult children's knowledge was apparent. Father's education was statistically significantly related to the total knowledge score made-up of all four tests combined, while mother's education was related to the magazine knowledge test. Additionally, father's education was related to how much reading their adult children engaged in, while mother's education was not. This suggests that by helping fathers or fathers-to-be gain more education, we are helping to create a second generation of adults who read more and know more. Since knowledge is power, investment in a father's education helps to empower the next generation.

BEST COPY AVAILABLE

CE085406

0

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

ERIC
Educational Resources Information Center

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Functional Context Education: Making Learning Relevant

Author(s): THOMAS G. STICHT

Corporate Source: 2062 VALLEY VIEW BLVD.
EL CAJON, CA 92019

Publication Date: 2000

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1 ↑ ☑	Level 2A ↑ ☐	Level 2B ↑ ☐
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) and paper copy.	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature: Thomas G Sticht	Printed Name/Position/Title: Consultant in Education	
Organization/Address: THOMAS G. STICHT 2062 VALLEY VIEW BLVD EL CAJON, CA 92019	Telephone: 619 444 9133	FAX: Same
	E-Mail Address: TSTICHT@AZNET.NET	Date: 8-12-03

(Over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, *or*, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

Acquisitions Coordinator
ERIC Clearinghouse on Adult, Career, and Vocational Education
Center on Education and Training for Employment
1900 Kenny Road
Columbus, OH 43210-1090

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to: